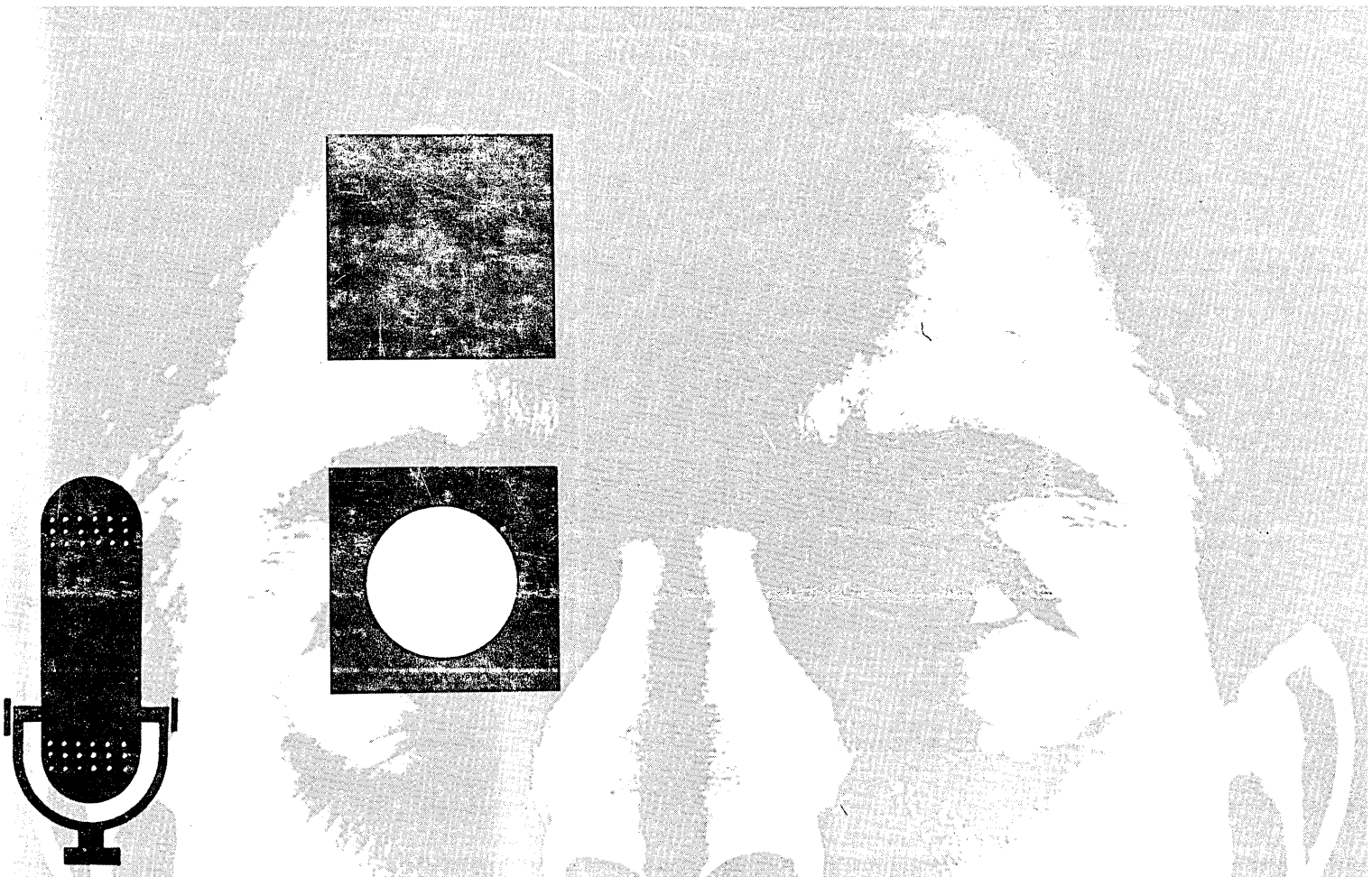
The Magazine of

AUTOMATION

'58

July/August

Research & Engineering



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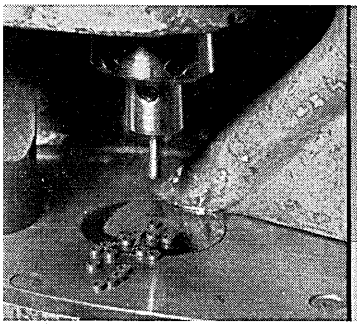
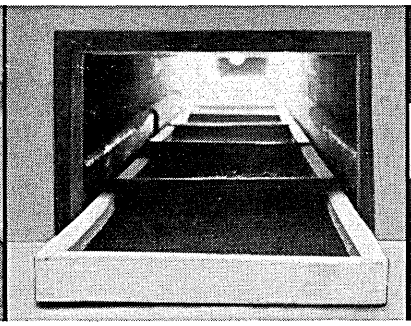
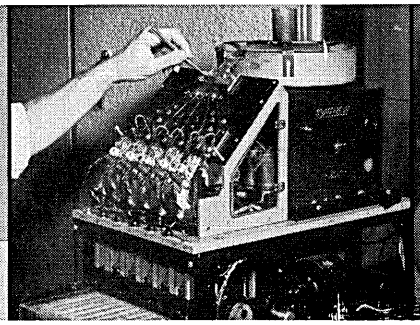
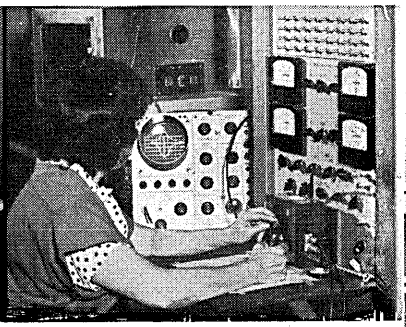

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DATAMATION 58

the automatic handling of information

volume 4, number 4

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R/E, The Magazine of DATAMATION, welcomes manuscripts of three general types: application articles dealing with small, medium and large electronic data processing systems; articles covering the design of components, sub-systems and systems; and other general articles of interest to the data processing industry. Material submitted should be accompanied by pictures and illustrations when possible. Unsolicited manuscripts to be returned to writer should include return postage but editor assumes no responsibility for their safety or return (although all reasonable care will be taken).

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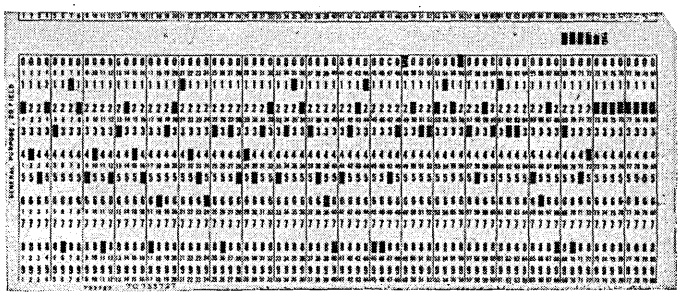

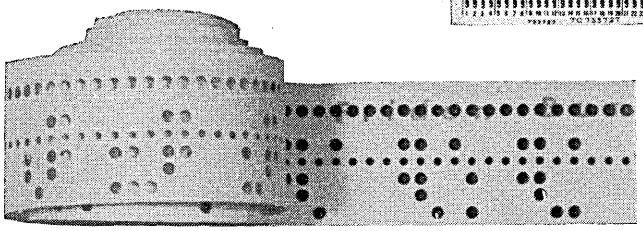

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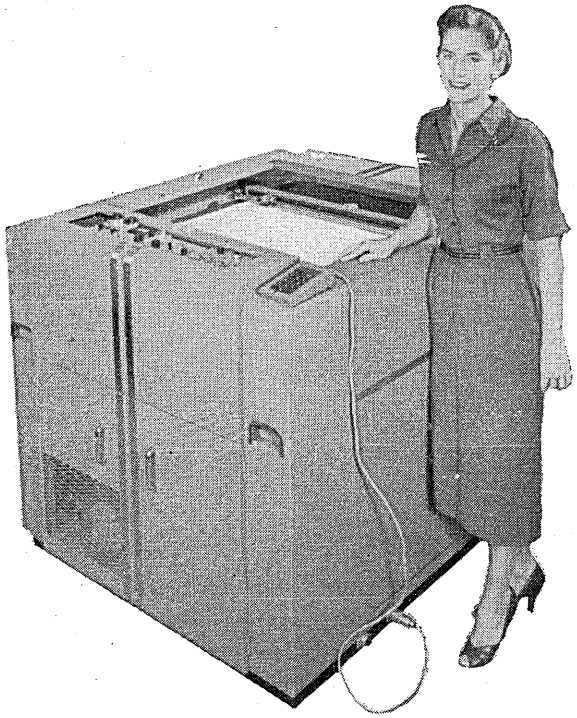

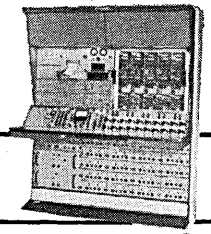

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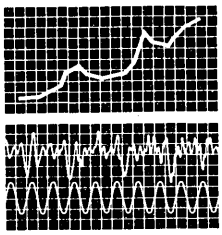

DATAMATION *in business and science*

EPSCO INSTALLS MULTI-CHANNEL DATA SYSTEM

Epsco, Inc. has delivered and installed an automatic, multi-channel data acquisition and computer linkage system at the Engineering Research Laboratories, Republic Aviation Corp., Farmingdale, L. I., N. Y. The system is being used initially to control data from air frame structural tests. Wind tunnel instrumentation applications will follow. Assembled from producion engineered building block modules, the system in its present form excites and processes structural analysis data from 200 low-level strain gage sources; sequences, amplifies, samples and converts the data into digital form at rates up to 4000 converters per second; and prepares magnetic tape for direct entry into a 704.

DR. MORTON: THINKING COMPUTERS COMING

The possibility of computers which might be able to think for themselves was foreseen by Dr. John A. Morton, Bell Laboratories' director of device development. He said that computers with from 10 to 100 times the speed and complexity of today's models "are almost a certainty. We can possibly look forward to electronic systems that can learn from past experience in helping themselves to solve new problems." He said that if we insist these machines cannot think, we will have to redefine our concept of thought. (See page five.)

NEW FACILITIES OPEN, UNDER CONSTRUCTION

A 102,000 sq. ft. facility housing the new data processing laboratory of Sylvania Electronic Systems, a division of Sylvania Electric Products, Inc., has been opened in Needham, Mass. Laboratory work includes development of Ballistic Missile Early Warning Systems for the Air Force and the Mobile Digital Computer System for the Army . . . . Aeronutronic Systems, Inc., a Ford subsidiary, is fast completing architectural and engineering work on a 125,000 sq. ft. computer development building. Construction was begun in late July at Newport Beach, Calif. and a completion goal has been set for next June. The facility will be a fully equipped structure for research, development and manufacture of special purpose computers.

CONTRACTS SET FOR EDPS MANUFACTURERS

Burroughs Corp. announced in Detroit that it has been awarded a $17,418,352 contract by the Air Force for the construction of 24 coordinate data processing systems to be used in the SAGE system of continental air defense . . . . Ramo-Wooldridge in Los Angeles now has a $13½ million contract for installation and operation of an automatic data processing system at the Army Electronic Proving Ground, Fort Huachuca, Ariz. . . . An air-ground communications system designed to cut air traffic delays and help solve the problem of mid-air collisions will be developed by RCA under a $1,400,000 contract awarded by the Airways Modernization Board. The contract calls for production of experimental equipment capable of obtaining flight information from up to 500 aircraft in two minutes.

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"What Mr. Von Newmann is saying here deserves careful consideration. The mathematical field of symbolic logic (or Boolean algebra) has been eminently successful in producing our modern control systems and digital computing machines. Nevertheless, the attempts to account for the operation of the human brain by similar principles have always broken down under close scrutiny. A different kind of mathematics—primarily statistical in nature—seems to be involved. The difficulty in comprehending the operation of the perceptron (even by a highly trained mathematical audience) could not be stated better than in this passage."—DR. FRANK ROSENBLATT, Cornell Aeronautical Laboratory.

DESIGN OF THE PERCEPTRON

For many years scientists have been endeavoring to produce an accurate model of the human brain. The processes by which the brain operates have been the subject of much study by biologists, mathematicians and engineers alike and the possibilities of using brain-like processes for the interpretation of extremely complex information have been the goal behind years of work.

A few weeks ago the office of Naval Research announced that some work which had been performed at Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y., indicated that at last a machine operating on the principle of the human brain appeared possible, at least as a laboratory model. The work at Cornell, performed on an IBM 704 computer, simulated the presentation to a crude visual, sensory device of a number of different stimuli. The system of perceptory interpretation consisted of a number of randomly connected repetitive circuits.

The 704 experiment showed that circulatory communication links would be set up in the connective repetitive circuits in a relationship corresponding to the appliance stimuli. After only a few applications of the appliance stimuli, the simulated system in the 704 was able to recognize which of the stimuli was presented to the input.

The concept of the perceptron was developed by Dr. Frank Rosenblatt, a research psychologist at Cornell working under contract with the Office of Naval Research. On July 7 he conducted a demonstration of the simulated perceptron system at Suitland, Md., for members of the press and other official observers. Many of the remarks which he made at this demonstration follow.

Dr. Rosenblatt began the story of the perceptron by posing a question which he calls one of the most controversial in the history of scientific thinking: Is it possible for a machine to have original ideas? This question, contends Dr. Rosenblatt, is the real keynote of our story.

"With regard to the perceptron," he said, "it appears that we must answer this question concerning original ideas in the affirmative."

On June 10, Dr. Rosenblatt explained, a successful experiment was conducted at Cornell. This experiment represents the first time a machine demonstrated its ability to form a spontaneous concept or idea based on its observations of visual forms and to attach symbols in a meaningful fashion to things that it sees.

In the June 10 experiment, the 704 used to simulate a perceptron was tested with the problem of distinguishing left squares from right squares. This task could be done quite readily by a conventional computer program using specially contrived rules. The important thing is that this was not a program for distinguishing left squares from right squares. It was a program which could have enabled the 704, equally well, to distinguish A's from B's, squares from triangles, pictures of ships from pictures of airplanes.

"If the 704 were many times larger and faster than it is and had the necessary sensory inputs," said Dr. Rosenblatt, "the same program would enable it to distinguish Fords from Chevrolets, Wagner from Mozart, bombers from fighters, airplanes from missiles."

What witnesses saw was a very simplified application of general and enormously versatile principles.

Dr. Rosenblatt continued:

"The perceptron is not a digital computer. We are used to hearing digital computers described as giant electronic brains and this is responsible for many popular misconceptions. Now, it is true that computers are very good at something, which people, by and large, do very badly—that is,

they do arithmetic. But this comparison of computers with the brain seems to me an unfortunate one. It suggests to many people that because a computer does certain things that the brain can do, the brain must work something like a computer. Actually, the way in which the brain works is still almost entirely unknown—although we believe that we may finally be on the right track . . .

"Computers perform two functions which they share with the brain: (1) decision making, based on logical rules, and (2) control. The human brain performs these functions together with a third form: interpretation of the environment.

"Why do we hold interpretation of the environment to be so important? The answer is to be found in certain laws which really stem from the physical science of thermodynamics. It can be shown that a system with a completely self-contained logic can never spontaneously improve in its ability to organize, and to draw valid conclusions from, information. Changes in such a system will, in general, lead to deterioration, rather than improvement, in performance.

"On the other hand, a system which is capable of reorganizing its own logic to correspond to a logical organization which already exists in the universe around it takes on very different properties indeed. Such a system can improve (if it is properly constructed) by observing and learning from the organization of the surrounding world. The human brain is such a system. It is this ability to interpret the environment which allows the human brain to recognize and devise the logical rules which are applied by the computer. Conceptualization of the environment is the first step towards creative thinking."

direct recognition

Continuing his explanation, Cornell's chief perceptron architect went on to say that the perceptron does not recognize forms, shapes, or other items by matching them against a stored inventory of similar images previously fed into it by an operator, nor by performing a mathematical analysis of characteristics. Instead, the recognition is direct, and essentially instantaneous, since the association by which a perceived stimulus is identified is derived in the form of new pathways through the system rather than from a coded representation of the original stimulus. This, Dr. Rosenblatt went on, is much like a man who gets a direct view of an object through his eyes from which impulses flow through his nervous system to the brain, in turn enabling him to instantly recognize and identify that object for someone.

Dr. Rosenblatt explained that the perceptual discovery of the "kinds" or "classes" of objects which make up our environment is quite different from the sort of activity which we go through in performing mental arithmetic or analyzing the possibilities of a chess situation. He stated that it seemed to be much more direct and intuitive; that our hypotheses emerge from observation and experience apparently spontaneously rather than as a formula solution.

The history of the perceptron program began at Cornell University as a study of memory mechanisms in 1953. The original experiments on the perceptron involved a "forced learning" process. Studies of perceptual learning continued at C. A. L. with the internal research program. Navy support began in July, 1957 under Project PARA.

The very important theory of Statistical Separability followed at this time. Then came the first simulation experiments aimed at proving ability of the perceptron to learn when specifically taught correct response. Although the problem of spontaneous organization was still unanswered last year, a new theory predicted spontaneous organization resulting from slight modifications in the original system.

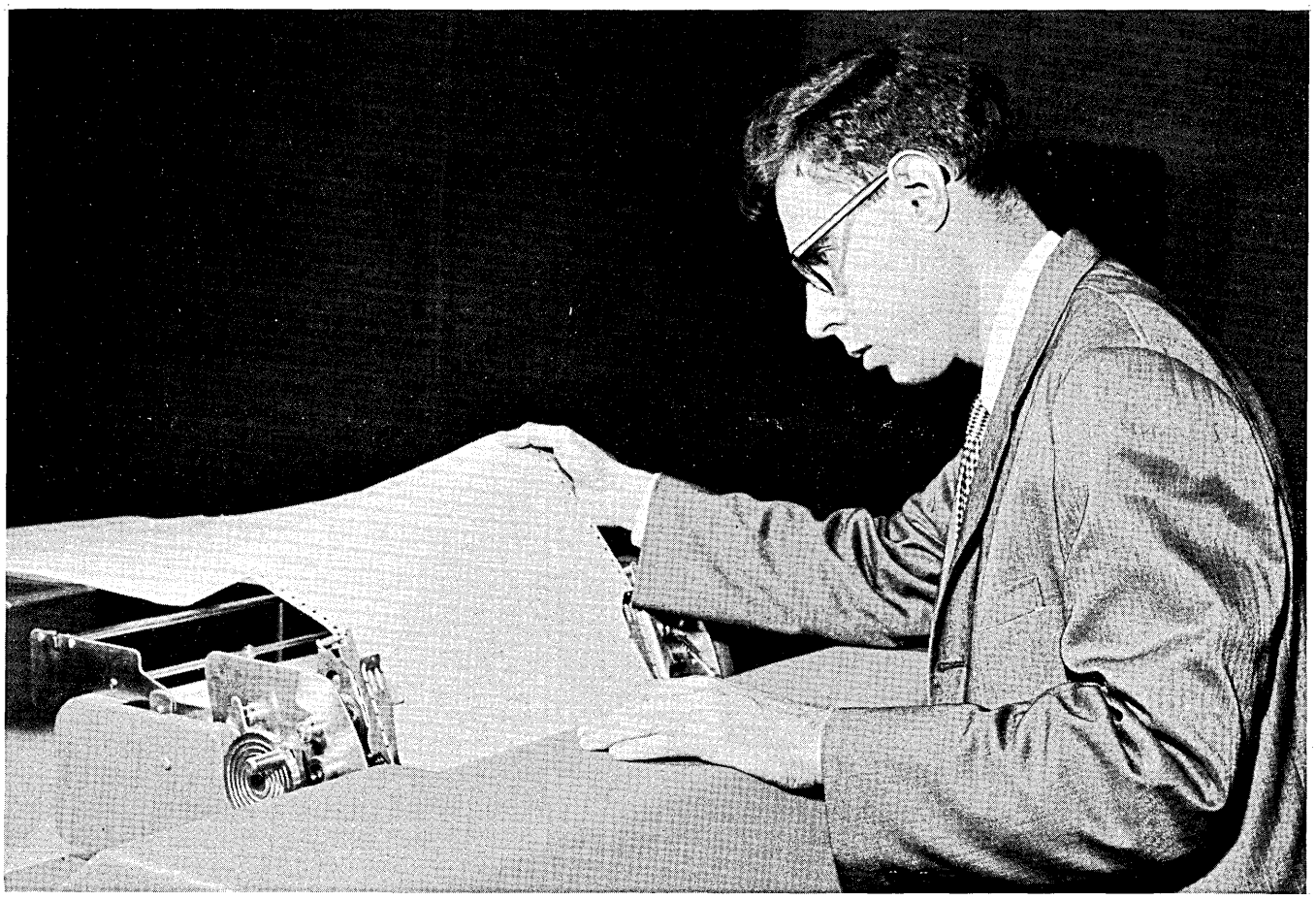
Finally, the successful simulation took place on June 10.

Dr. Rosenblatt emphasized the difference between the perceptron and the 704 used for the simulation experiment. He explained that in the perceptron simulation program the computer must follow specific rules since this is all it can do. The rules which are used here, however, are not the kind that tell it how to derive the answer to an explicit problem, such as multiplying two numbers, or telling A's from X's. The rules are specifically concerned only with the changes in the perceptron which result from its experience. They are rules for changing the responses of the system so that, as time goes on, the same data (the data in this case being coded images of visual forms) will yield different answers. They are, in short, rules which control the adaptation or learning that goes on as the machine gains experience from the particular artificial environment that we have contrived.

Continuing, Dr. Rosenblatt pointed out that the 704, like any digital computer, is very inefficient when used in this way. There are at least three major differences between a digital computer and a perceptron which stem from differences in organization of the two systems.

The main differences are in speed, size, and couplings with the environment (the inputs of the system). The experiment which will take some 15 or 20 minutes to perform on the 704 might require only a few thousandths of a second on a perceptron. To equal the memory capacity of a perceptron which might ultimately be built in the size of an office desk, we might require hundreds of 704 memories. In the simulation program, the environment, as well as the wiring diagram of the perceptron must be stored in the memory of the 704. The 704 has no "sensing organs" which would enable it to accept visual forms or auditory inputs directly. Such input devices will, of course, be available for the perceptron.

"We plan to build an actual pilot model of the perceptron in the course of the coming year," said Dr. Rosenblatt. "This first model will be quite elementary but will be capable of doing at least as much as the digital simulation programs can do and probably somewhat more too. I must emphasize that we are not yet ready for advanced applications of the perceptron. The development and exploration of this concept, however, appears to be one of the



Cornell Aeronautical Laboratory's Dr. Frank Rosenblatt, research psychologist, checks simulation results of the perceptron, first non-biological system capable of perceiving, recognizing and identifying its surroundings. Actual perceptron model to be built within year.

most important scientific challenges of our time."

The psychologist cited two reasons for this position: (1) the theory of the perceptron is the first "brain model" to be wholly consistent with whatever is known of the biological nervous system. Unlike previously proposed systems, the perceptron does not violate any known facts about the central nervous system. (2) aside from its purely scientific importance, systems similar to the perceptron could possibly serve a most important function for the western world. Our survival may some day depend on our ability to make speedy and accurate interpretations of very complex data. An advantage in the field of intelligent automata might go a long way toward making up an initial disadvantage in other fields. Such a possibility cannot be ignored.

some applications

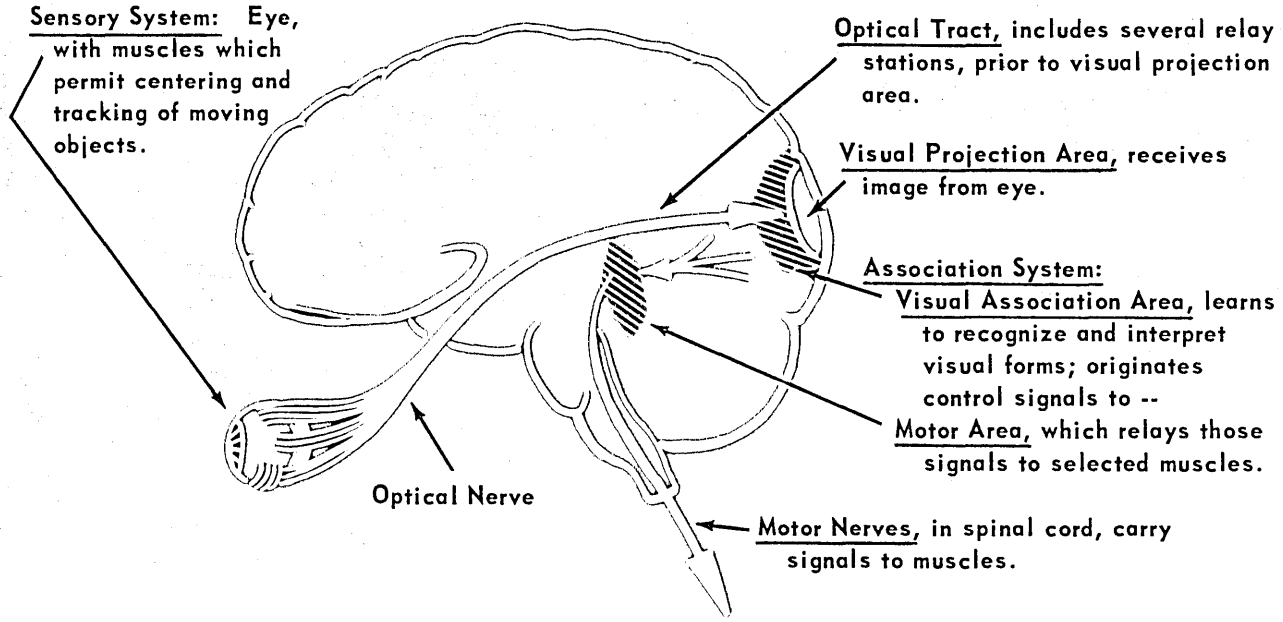
Automatic landing systems, automatic pilots, and recognition systems of almost every variety could conceivably make use of the perceptron, and its application to library research and data gathering for scientific purposes already seems clearly indicated.

Many applications, while actually within the realm of achievement, are still a part of the future and really cannot be fully or properly evaluated at this stage of perceptron's development. The concept of this system is still in its infancy, and its basic theory must first be extended.

Additional steps to be taken will involve such things as: lowering the cost and size of its construction well below that of units which can now be built with conventional components presently available; studying the behavior of laboratory models in response to environments ranging from the mixture of simple geometrical forms, now being simulated by current programs, to such complex problems as the discrimination of speech and human faces; and development of sensing devices suitable for providing visual and auditory inputs to the system.

Although practical applications of the perceptron program, which is a major undertaking, should not be expected in the immediate future, nevertheless it now seems clear that with the perceptron, a new field of research, both for engineering and for the theory of intelligent systems, has come of age.

HUMAN BRAIN: Receives information from the visual world, recognizes and identifies images, and transmits signals to body muscles. The brain acts on information from other sensory channels in similar fashion.

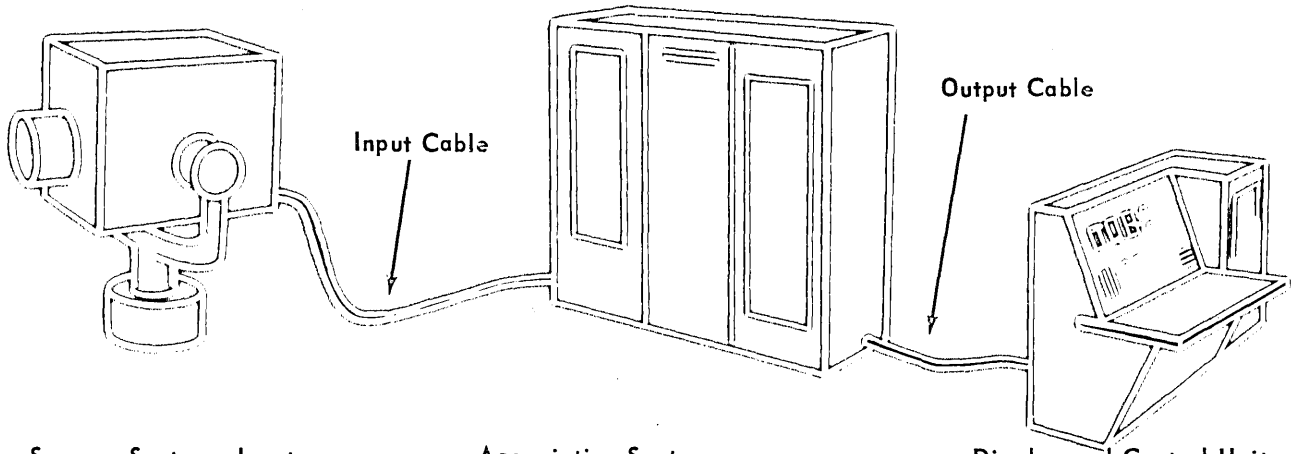


The illustrations on these pages show the similarity in general functional organization between a perceptron and a brain. The perceptron receives visual images through an optical device which is somewhat similar to a TV camera. A mosaic of photocells in this device serves a function similar to that of the retina in the eye. These photocells transform light energy into electrical signals, which are carried by a cable to the Association System. This system is composed of a great number of small electronic units which appear to be similar in function (and in their "wiring diagram") to the association cells in the brain. These units respond to the "visual" input signals, and generate electrical impulses, which are analogues to the nerve impulses generated by association cells.

The association system acts primarily as a relay station, which can change the connections between input and output units by strengthening the signals in some channels and weakening the signals in other channels. The connections of the system are largely random, although the general flow of impulses proceeds from the sensory end to the response end. The effects by which the association system is able to "remember" the preferred connections are primarily statistical, or probabilistic.

These effects were predicted and analyzed for the first time in Rosenblatt's "Theory of Statistical Separability," which was originally released in a Cornell Aeronautical Laboratory report in January, 1958. This theory shows how it is possible for the same association cells to respond, in an apparently identical manner, to a great variety of different stimuli, while the statistical aggregate of association cells is still able to respond selectively to each individual stimulus. The predicted effects can be observed

PERCEPTRON: Receives information from the visual world, recognizes and identifies images, and transmits signals to control motors or recording devices. For auditory pattern recognition, the camera can be replaced with a microphone.



Sensory System: Input camera, with aiming servos, which allow Perceptron to center or track moving objects.

Association System: learns to recognize and interpret visual forms; originates control signals to servos and recording devices.

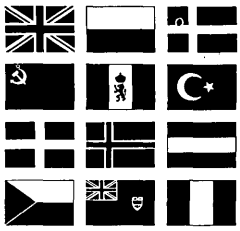
Display and Control Unit: permits experimenters to observe performance and to control the learning process.

only in large numbers of cells. Once a sufficient number of cells is obtained, a perceptron becomes a highly efficient system, capable of recognizing similarities, forming generalizations, and discovering for itself the classes of forms of which its environment is composed.

Systems which operate on the basis of "statistical separability" are fundamentally different in principle from digital computers, and form control systems which carry out their operations by symbolic logic. Unlike a digital computer, in which the clipping of a single wire might incapacitate the machine, the perceptron will continue to function even if a large fraction of its association system is destroyed. Furthermore, a perceptron can be "designed" by wiring its units together at random, so long as certain general constraints are observed. Small differences in the wiring diagram, such as interchanging sets of wires, are likely to make no difference at all in its ability to perform.

The first perceptron to be built will be designed as a laboratory research tool, in which patch boards will permit the flexible interconnection of units in different ways, for experimental purposes. According to present plans, the laboratory model will have an input system consisting of 400 photocells, and may have as many as 1000 association cells, or "A-units." This system should be capable of distinguishing letters of the alphabet, simple visual forms, and pictures which are sufficiently dissimilar so that the perceptron is not confused by their similarity.

Larger systems would be capable of recognizing much finer shades of difference in visual forms, and could accept auditory, or other input media, as well.



DATAMATION *abroad*

SYMPOSIUM SET TO REVIEW ANALOG FIELD

In Strasbourg, France, the International Association for Analog Computing will hold an international symposium on the problems of analog computation from Sept. 1 to 7. The symposium will be divided into three sections: mathematical and physical problems in analog computers, diverse applications, and simulators and relations between analog and digital computers. Symposium organizer is Dr. F. H. Raymond, c/o S. E. A., 138 Boulevard de Verdun, Courbevoie (Seine), France. An exhibit of analog computers will also be held from August 30 to Sept. 8.

FIRMS IN JAPAN BUY U.S. EDP EQUIPMENT

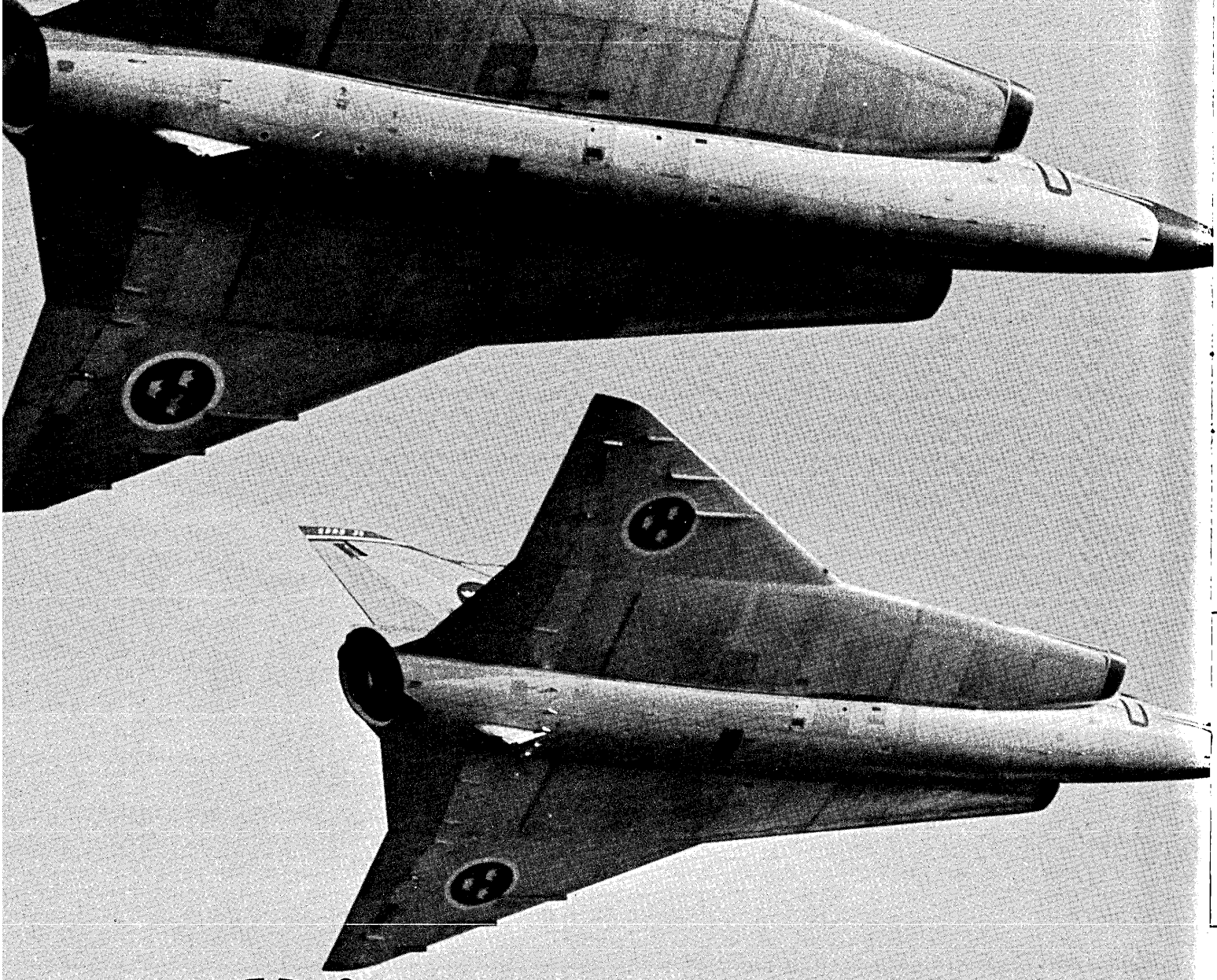
Japanese firms are showing increasing interest in computer installations and sales of U. S.-made general purpose machines are being made to banks, government agencies, electrical manufacturers and heavy industry companies. Remington Rand has delivered 28 Univacs, twenty-two 120's and six 60's while IBM reports 10 orders for 650's and one each for a 704 and 705. So far, the two firms have graduated about 700 from training courses on their various models . . . A Bendix G-15D computer delivered to the Japan National Railways in May, 1957, has already brought about a 10% efficiency increase in the movement of commodities, according to Mamoru Hosaka, research engineer in the railroad's automatic control laboratory.

CEC SUBSIDIARY OPENED IN FRANKFURT

A German subsidiary, Consolidated Electrodynamics Corp., GmbH, will serve as a central sales and service facility for the parent California firm in Western Europe and the United Kingdom. The wholly owned subsidiary will provide improved and direct factory service to users of CEC's data processing instrumentation and analytical and control equipment. Located at Weissfrauenstrasse 3, Frankfurt am Main, the company will also serve CEC's European network of sales representatives. A. W. Brandmaier is manager of the German company.

BOOK, BULLETIN NOW AVAILABLE ABROAD

Three translations of the book "Office Work and Automation" by Howard S. Levin, published by John Wiley and Sons, are now available abroad. In Holland, the publisher is J. H. deBussy, Amsterdam; in Germany - Nest Verlag, Frankfurt; and in Japan - Dobunkan Publishing Co., Tokyo . . . . Bulletin of the International Computation Center, a monthly tabloid magazine, is currently being published in Rome. English and French editions are printed. For information write the Center at Palazzo degli Uffici, Zona dell'EUR, Rome.



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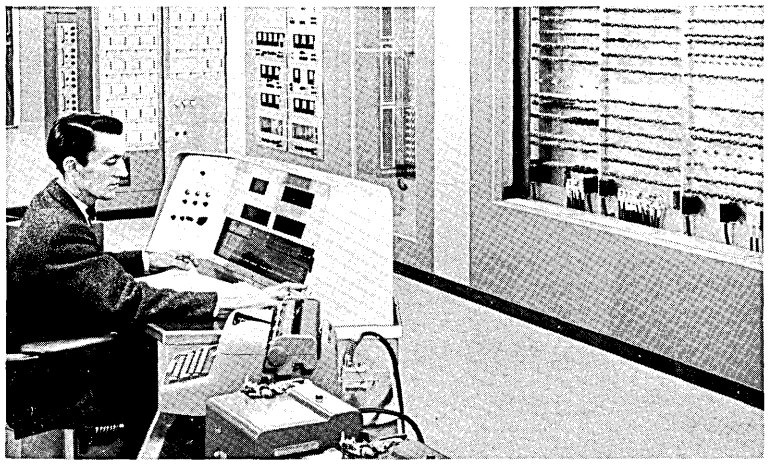
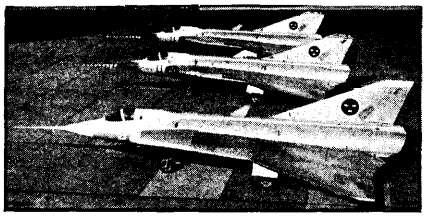
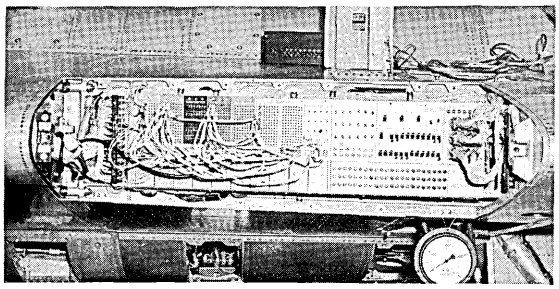


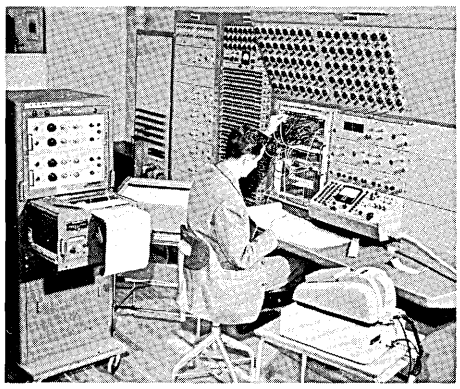


Left: SARA's control desk surrounded by IBM and Creed equipment. Page 12 and above: Swedish Air Force's Dragon. Lower left: Dragon measurement centers in starboard armament bay. Lower right: SEDA, built by Saab and Electronic Associates, Inc.

DIGITAL COMPUTING AT SAAB

sweden's only aircraft manufacturer applies technical data processing





by ETIENNE J. GUERIN

DATAMATION Correspondent in Northern Europe

In Scandinavia, Svenska Aeroplan Aktiebolaget – SAAB in short – dominates the picture as a leading user in electronics. Their engineering staff has successfully put them to work for high-speed aircraft manufacturing.

Saab is Sweden's lone aircraft manufacturer. A private enterprise, its main plant is located in Linkoping, 125 miles from Stockholm. The largest part of its output is delivered to the Royal Swedish Air Force – Flygvapnet – which consists of 50 squadrons or some 1,000 planes. The Saab-32 Lansen, a two-seater all-weather jet fighter bomber with air to ground missiles, is currently being produced on a large scale in different versions. Latest model is the Saab-35A Draken (Dragon), a supersonic single-seat double delta wing jet interceptor equipped with air-to-air missiles and other weapons. The Draken has a top speed of Mach 1.8.

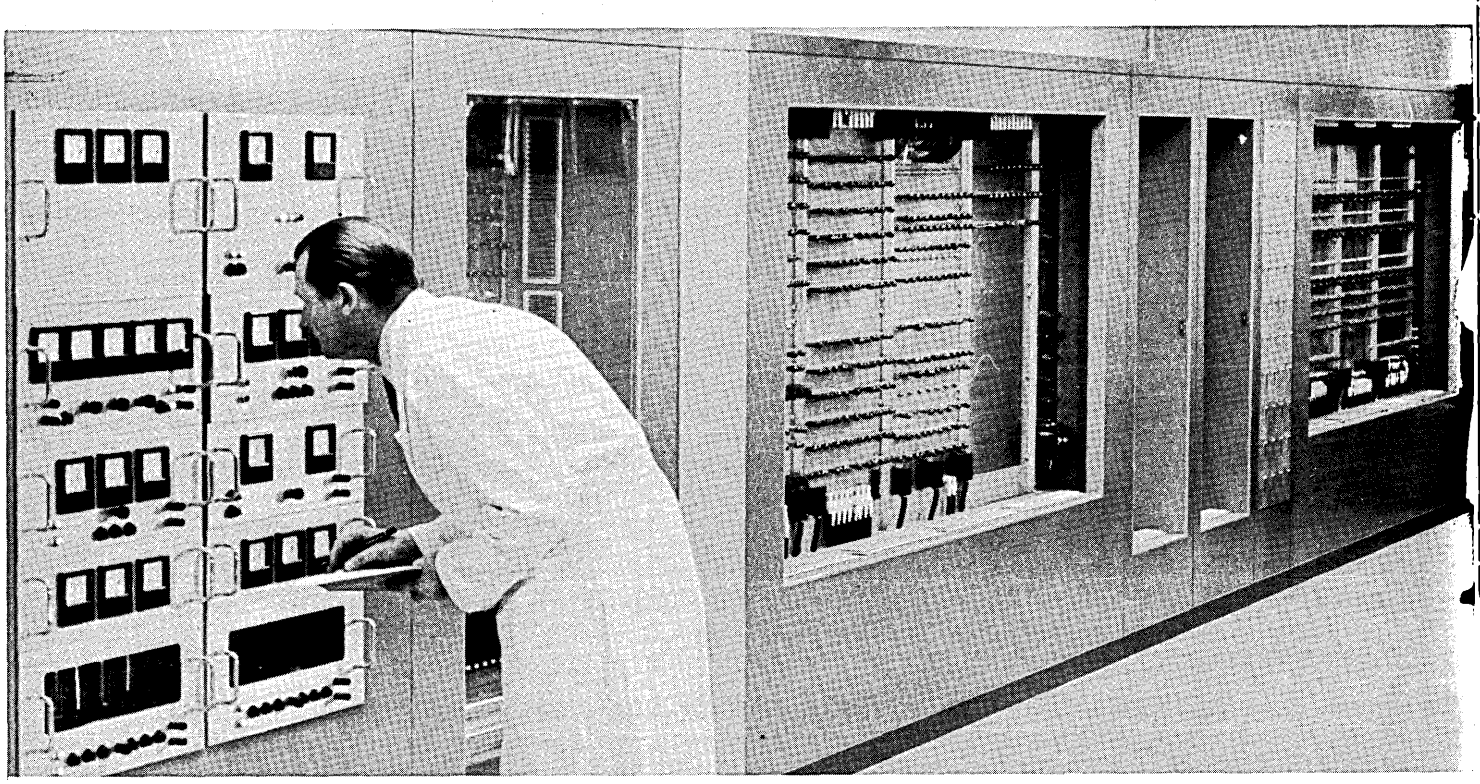
Except for the engine, the armament and some smaller components, the Draken is entirely engineered and produced by Saab. Aviation experts praise its first-class engineering, the technical ability behind it as well as the close cooperation between Saab and Flygvapnet (i. e. the Air Force).

Saab works on a cost plus basis, on orders from the Royal Swedish Air Force. Last fiscal year, Air Force appropriations amounted to $100 million. Next fiscal year, equipment appropriations will be raised to $150 million. These funds cover procurement and development of new equipment. The Swedish Air Force's future equipment is governed by a 7-year program with a cost limit of some 1 billion dollars. This program is "rolling," i. e. revised annually to cover latest requirements.

Prototype work is normally done on 3 flying test airplanes and one ground structural test airplane. It may also be mentioned that Linkoping offers an average of 200 fine weather flying days a year, thus giving less than 100 flying hours a year to test airplanes. For instance, an aircraft which was ready for flight testing before Christmas could only be tested at the end of January. This partly explains the need of rapid data processing at Saab.

Saab uses an integrated automatic computing system from the early stages, which speeds considerably the preliminary design process. That covers all the engineering phases, such as aerodynamics, thermodynamics, layout drawing, weights and structures, fitness for production, and many other properties.

This is reflected in the organization chart of the company which employs more than 1,000 persons in its different engineering divisions. Engineering is divided into



Left to right, SARA's power supply, drum, control, memory and arithmetic units, control desk relays and storage buffer unit.

experimental analysis, theorical analysis and design. The department of theorical analysis itself is subdivided into aerodynamics, structure, flutter, numerical lofting and a technical data processing bureau. This serves all engineering phases of aircraft manufacture.

sara, a digital computer

Saab has built its own digital computer, SARA, which is short for SAab RakneAutomat – or Saab Computer. It was first tested late in 1957.

SARA is an improved version of BESK – Binary Electronic Sequence Computer or Binar Elektronisk Sekvens Kalkylator in Swedish – built in 1954 by the Swedish Board of Computing Machinery, Matematikmaskinnamnden. This was incidentally the second computer built by that semi-official agency, the first one BARK – Binary Arithmetic Relay Computer or Binar Aritmetisk Rela Kalkylator – being basically a mathematical relay using a plugboard program. BESK is comparable to an IBM 701 except that programs are on tape instead of cards.

Although the 512-word Williams tube memory of BESK had given satisfactory results during the period Saab used it prior to SARA's operation, Matematikmaskinnamnden later on decided to substitute for it a core memory with 1,024 words. SARA also uses a 1,024-words, each word of 40 bits, ferrite core memory and it is soon to be doubled to 2,048 words. 2 magnetic drums each storing 4,000 words have a revolution speed of 3,000 rpm. Addition time, 60 microseconds, multiplication, 400 microseconds.

Input used is a Ferranti Mark II High-Speed 5-channel tape reader, with a speed of 200 digits per second. Output is a Creed tape punch with a speed of 25 digits per second. A new output will soon be installed, a BESK high-speed punch with a speed of 150 digits per second, reputedly one of the fastest in the world.

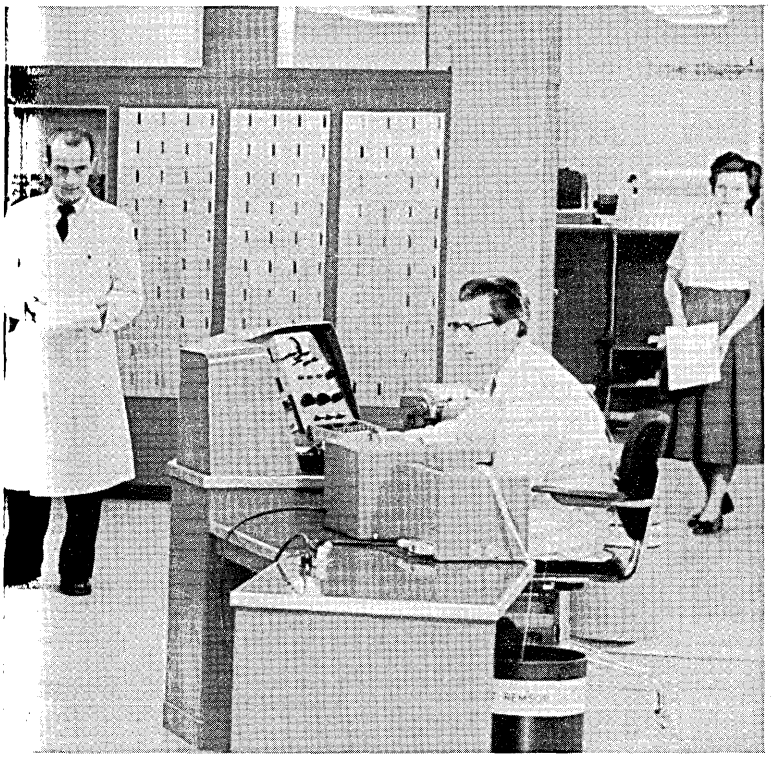
Saab is in the process of installing in SARA six Ampex 212 magnetic tape recorders with a tape speed of 60 inches per second. The basic unit is usually delivered with a tape speed of 30 inches per second, and that alteration was done as a custom order.

Saab plans to build in the near future, a transistorized storage buffer unit with logical circuits mounted on printed circuit plug-in assemblies. It will be used as an output buffering system to provide compatibility with an IBM 528 accumulating reproducer as output equipment on SARA. We should mention also that this machine has different feed speeds: 200 cards per minute at the input and 100 cards per minute at the output.

Future plans also include the use of an external core storage to replace the drum function in SARA, with its probable use as a storage buffer unit. This will tentatively be effected in about 2 years time and these changes will be made progressively when the storage buffer unit and punch card equipment mentioned above, have been installed.

seda and others

Saab also uses two IBM 604 electronic calculating punches, an IBM CPC and the Saab Electronic Differential



Analyzer (the SEDA). SEDA is the principal tool of the Saab Analog Computing Center which is part of the organization of the Systems Engineering Department. They have been using it extensively for different problems of guidance and control of military aircraft, often with hardware from the aircraft included in the computing circuitry. Other departments, too, can have their problems solved at the center. The aerodynamicists, to quote an example, have found it useful when treating problems of aerodynamic heating.

At present it is the biggest analog computer in Sweden. Apart from two or three racks of multipliers and diode-resistance-function generators built by Saab, all the equipment comes from Electronic Associates, Inc. of New York. It includes in its present form and among other items, 140 DC-amplifiers, and three plugboard and control desks. This makes it possible to compute two or three problems at the same time, if they have convenient size. A big problem, of course, will occupy all the machine. As a matter of fact, the problems tend to outgrow the machine, so it will have to be considerably enlarged in the near future.

The company has conducted special studies in applying matrix analysis to structural analysis. The process of synthesization is used in the preliminary design of an airplane. It is employed to make parameter studies such as wing areas, tail sizes, etc. Because of the aerodynamic requirements as well as those of the production people, Saab has developed a method to define the aircraft's geometry in mathematic form, i e the earlier body plan-view has been replaced by a table of coordinates, where a number of points taken at random on the frame are defined by numerical values. This method of numerical lofting which was pioneered in the aircraft industry by Saab has produced remarkable results in work simplification. Stress problems and numerical lofting are mostly calculated on the IBM 650 following the matrix procedure mentioned briefly in this paragraph.

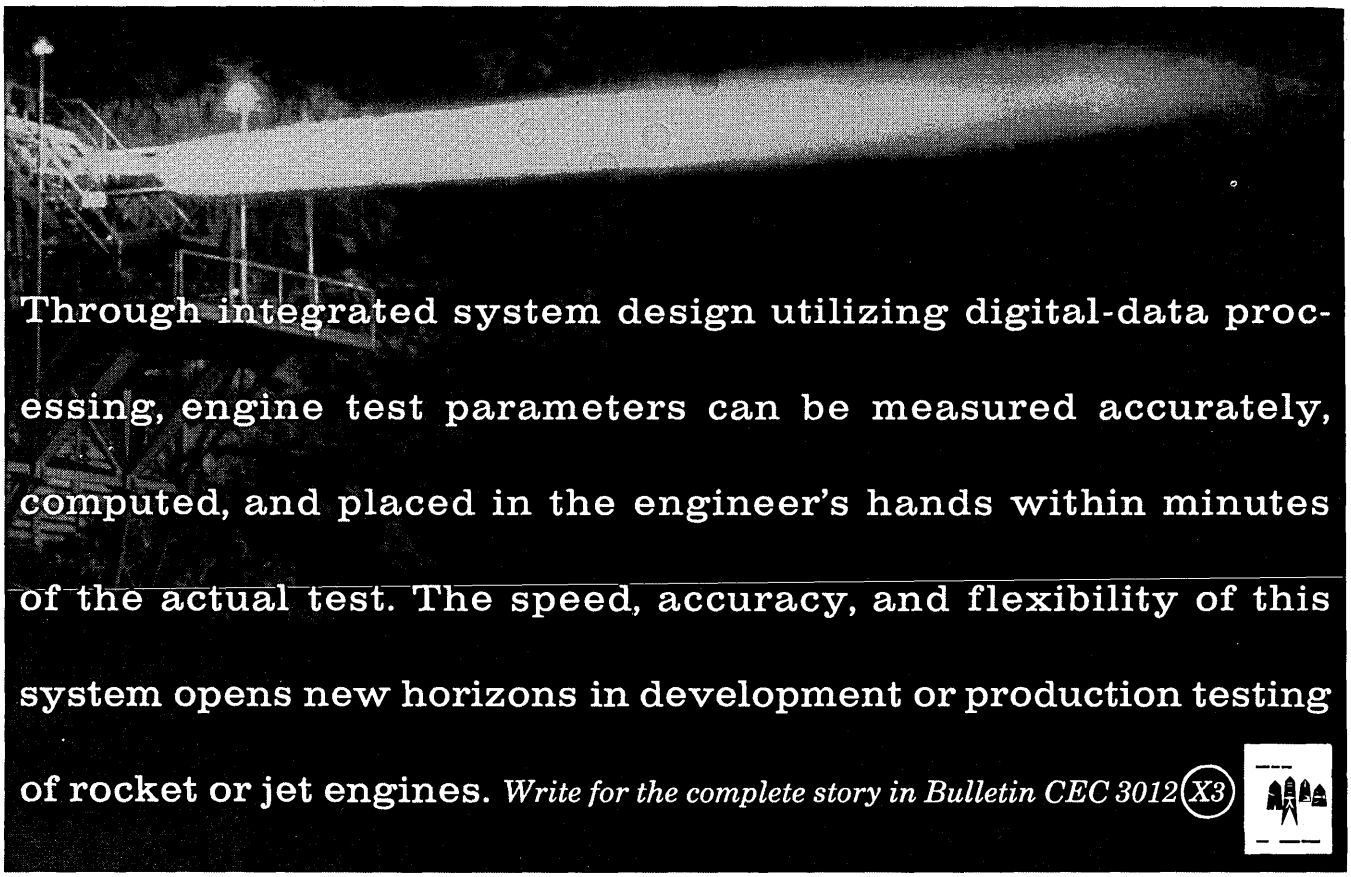
The final characteristics of an aircraft and its operational capabilities are function of the accuracy with which a given number of aerodynamic parameters of the air mass through which that aircraft flies can be measured. Air data, as these parameters are collectively referred to, include total pressure, static pressure, angle of attack, angle of sideslip and temperature from which other information is in turn derived. These measurements have become increasingly difficult to make at high speeds and altitudes because of the dynamic and static transducer response limitations, and the computing and indicating system limitations. With SEDA, the analog computer, the air forces are represented by a rational approximation of the reduced frequency for which the integrators can be used in the case of the positive powers, and for which special passive network inpedances are used in the case of the negative powers. Flutter analysis is done by turning a gang-potentiometer representing flight speed, until the cathode ray image shows zero damping on the transient, which is repeated on the cathode ray screen with a frequency of about 20 cps.

test flight data handling

The future will reflect deep changes in data processing at Saab and especially in the work of data reduction. A spokesman stated: "After making preliminary studies in order to determine what type of data recording Saab should use, the engineering department has reached the conclusion that data should be recorded on tape." One principal reason why oscillographs will progressively be replaced by tape recording is the possibilities of rapid automatic flight test data handling. Another is that vibration and noise can be recorded up to higher frequency ranges on magnetic tape and are easier to analyze. For the present, flight test data are recorded on oscillographs and photographed instrument panels. In one such instance, two Heiland oscillographs occupied the whole of a Draken radar nose section during recent test flight measurements. Using the port and starboard armament bays as measurement centers, the pilot can easily switch from one to another different type of program while in flight, thus saving time.

In some cases oscillographs are analyzed with oscillogram readers, type Benson-Lehner Oscar E, and with one type designed by Saab and based on Speedomax mechanical. When oscillographs were used, the main complaint was that either photographs or an oscillograph manual were needed for interpretation, a practice found to be too time-consuming. Of the very extensive flight test pro-

computed data in 60 seconds



Through integrated system design utilizing digital-data processing, engine test parameters can be measured accurately, computed, and placed in the engineer's hands within minutes of the actual test. The speed, accuracy, and flexibility of this system opens new horizons in development or production testing of rocket or jet engines. *Write for the complete story in Bulletin CEC 3012* (X3)

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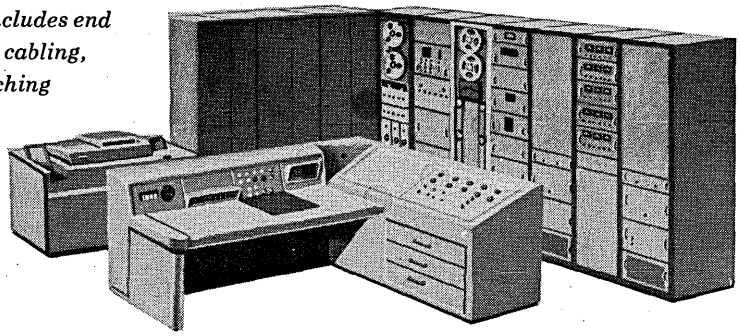
CEC

The system includes end instruments, calibration, cabling, data-conditioning, patching facilities, analog-to-digital conversion, timing, analog magnetic-tape equipment, and digital computer.



Circle 5 on Reader Service Card.

grams, automatic data reduction in computers has been made preferably on strain gage measurements, such as wing and tail-loads and five-component load measurements on external stores. Pressure-distribution measurements and theodolite data have also been handled in digital computers.

Saab's way of recording data on tape is original. They use 8 channels for data and no sprocket hole. Three channels are used for word and block pulse, in order to save simpler logic, and 5 checking channels instead of the usual one—offering greater accuracy than the standard system. One pulse error is self-correcting, 2 pulse errors register an error signal.

Also the use of fixed block numbers on the tape permits a tape search on a single tape unit while simultaneously reading or writing on another tape.

Future plans include the recording of flight test data in FM (analog) and digital forms. This is the way it will probably be done, subject of course to changes during proving time. FM wide band and FM/RDB will be used for modulation of vibration, noise and transients, while static and quasi-static data will be digitized by a Minidatrac DAC in the airplane and will be recorded on magnetic tape.

Saab's Test Instrument Section is at present working on a strain gage bridge excitation system, whose main advantage is the elimination of correction for drift of bridge voltage. It is based on pulse excitation of the bridge and switching on the input voltage side.

The requirements of jet aircraft testing have proved that pulse modulation alone is not accurate enough. Also in the future studies realm comes the determination of which type of quick look system will be the best applied to tag important data parts for processing purposes. Then special equipment will be engineered to scan parts of magnetic tape in the quick look system and to translate automatically the tagged parts into SARA (digital) input tape.

Equipment on hand includes an Ampex 800 and another magnetic tape recorder which will soon be delivered by Consolidated Electrodynamics Corp.

data reduction

Data recorded on magnetic tape permits instant playback and unlimited analysis features. Tape playback speed can be considerably reduced and rapid transients can be recorded on low-response equipment for a detailed study. Basically waveshape and Fourier analysis of the waveshape are the basic data required here.

Costs in engineering computations have been reduced, the elapsed time for obtaining the solution to engineering problems has also been reduced, and problems involving parametric investigations have been solved promptly, which would have been impractical to be solved any other way. As stated by Borje Langefors: "The experience so far has been very promising and led to the conclusion that the procurement of still more effective computers is worth while." And after issuing a warning, "we have had some occasions where the machines have helped us to obtain results in much shorter time than we dared to hope, but it should also be admitted that we have at times failed to have results ready when desired." His conclusion was on a cheerful note: "The net results have been important gains in cost savings, accuracy and speed and the main question seems to be if development will ever be fast enough to keep pace with our (at Saab) continuously growing appetite for high computing capacity."

BORJE LANGEFORS, 43, is head of the Numerical Analysis Department at Saab. He graduated from the Malmo Technical School and received mathematical training at the KTH (Royal Technical College) and the University of Stockholm. He visited the U. S. in 1954, touring IBM facilities in New York and the MIT center for servo mechanisms. He also visited Douglas and Northrop aircraft plants in California.

LARS SJODIN, 36, is chief of Saab's Data Reduction Department, Measuring Section. He started with Saab in 1945 and left only long enough to attend and graduate from the Royal Institute of Technology in Stockholm in 1954.

SVEN YNGVELL, 30, is chief of the SARA Programming Section. Here he supervises 30 people. Yngvell has a BS degree from Lund University in Southern Sweden.

These are the personalities who, along with Hans G. Anderson, Saab public relations head, kindly discussed their work and projects with the author, and to whom he expresses his thanks.

The addition of constantly improved electronic equipment, new integrated systems to maintain a balanced data processing flow, the solution found to data reduction problems, and the broad plans for the future should certainly not fail to bring out better and faster aircraft from Sweden's aeronautical engineers.

and sara can sing

SARA has a built-in loudspeaker and their programmers have prepared a Swedish song, Oxdragarsangen (Oxen cart driver song) by troubadour Evert Taube. Here are SARA's basic operations with their code:

+ 00 - minus 01 - 1+1 02 - 1-1 03 - etc.

which by using a musical scale gives:

300 1D0081A008 1A00818008 180082C110 1800818008
308 1A0081A008 1900819008 1F1181F108 1A0081A008
310 1800818008 2C11018008 180081A008 1A00819008
318 190081F118 1F1081A008 1A0081F108 1F1081A010
320 1F1081F108 1900819008 1E0081E008 1D01000008
328 1F1081A008 1A0081F108 1F1081A010 1F1081F108
330 1900819008 1E0081E008 1D0101D008 C000000000

That was the lighter side of SARA, but the other one is quite busy with serious work.

reading the high speed printers

In the January/February issue of DATAMATION, a detailed article was presented covering a survey of computer output devices which present data in graphic form. In that article your editors mentioned that we would, in a later issue, offer a survey of high speed tabulating devices. The information from this survey is presented herewith.

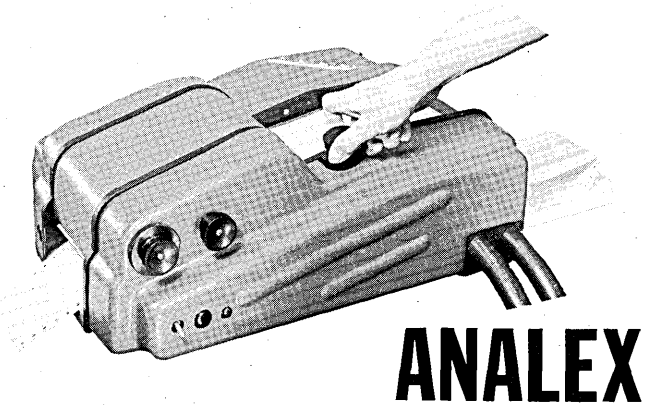
The development of high speed printers has taken place along three lines—(1) mechanical printers, (2) cathode ray tube display devices and (3) those using the electrofax techniques.

All of the above have distinct advantages and disadvantages depending on the application and the computing devices with which they will operate. The descriptive data was obtained directly from the manufacturers and more details on all units may be obtained by circling the appropriate number on the reader service card.

Pictured on these pages are units from Burroughs Corp., DATAmatic, a Division of Minneapolis-Honeywell Regulator Co.; Remington Rand, a division of Sperry Rand Corp.; National Cash Register Co.; Stromberg-Carlson, a division of General Dynamics Corp; and International Business Machines Corp.

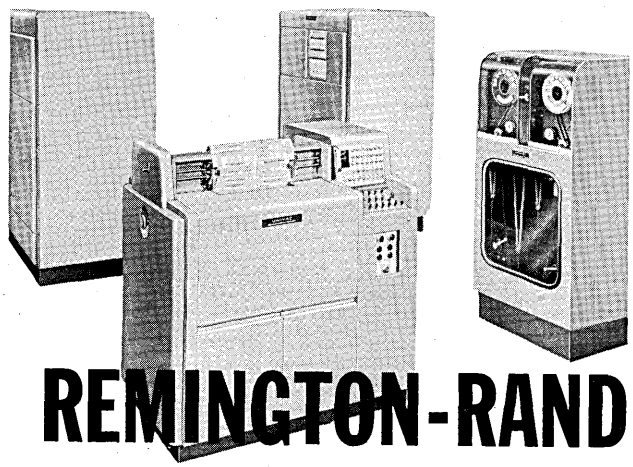
BURROUGHS

Electrographic Recording is a technique by which messages can be received automatically and the electronic impulses assembled into printed characters and words at a speed of 30,000 matrix characters per second. Either matrix or preformed characters may be obtained. In application, controlled, visible dots by direct electrical impulse means are produced. The Burroughs process utilizes a controlled source of electricity to form small charged areas on a surface such as coated paper. The electrostatic latent image formed by the charged areas is made visible by application of powdered ink, permanently fixed by heat. The recording head comprises 35 tiny wires leading into and through a triangular piece of plastic. The wires are polished flush with one corner of the triangle, or printing head, to form a rectangle seven wires high by five wires wide. This is the matrix — 72 of them in a row to form a printing line. They do not touch the paper but are maintained at a fixed distance from the surface. Electric pulses will selectively charge all 35 wires or any combination of those wires in each head to form a symbol.



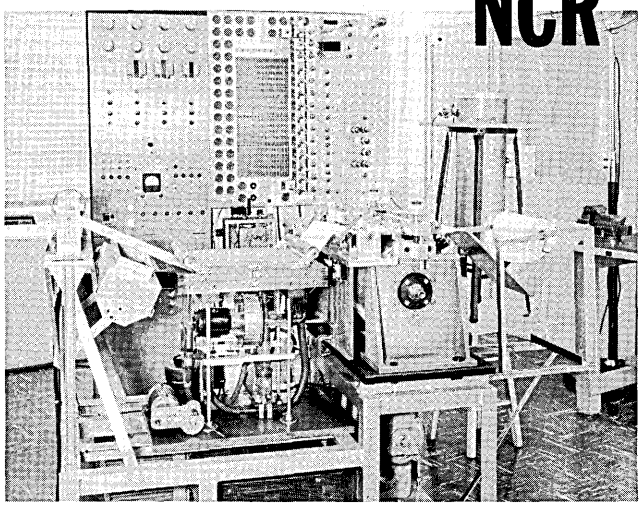
Analex Corp.'s series 56-24 desk model prints on four inch wide single, multiple carbon or heat transfer type forms. The printer provides 24 possible printing positions in each line – and any one of 56 (or 64) characters may print in each position. Columns are spaced 10 to the inch and lines are spaced six to the inch. Printing rate may be up to 600 lines per minute for alpha-numeric printing or up to 1200 lines per minute for numeric printing. The 56-24 may be used with a decoder to print directly from a computer or, by supplying the proper reader, buffer and control units, it may be used in off-line operations to print from magnetic tape or punched cards. This unit can be used to print out real time data from automated manufacturing processes and for check listing, addressing, computation and inventory control.

Datamatic's converter and printer was designed for data processing requiring a high document-per-hour printing rate. The converter unit accepts information from magnetic tape, provides any editing or format arrangement desired and converts the information signals into impulses which operate the printer. Some converter editing features: Any number of characters may be deleted from a given line of print, any combination of characters may be emitted on a constant or variable basis, the information to be printed can control its position on a given line, and control of field information is completely flexible. One operating feature of the converter – every phase of information transmission from magnetic tape to print hammer is verified automatically utilizing special weight count, parity and echo-back checking. Printer specs include printing speed of 900 120-character-lines per minute.



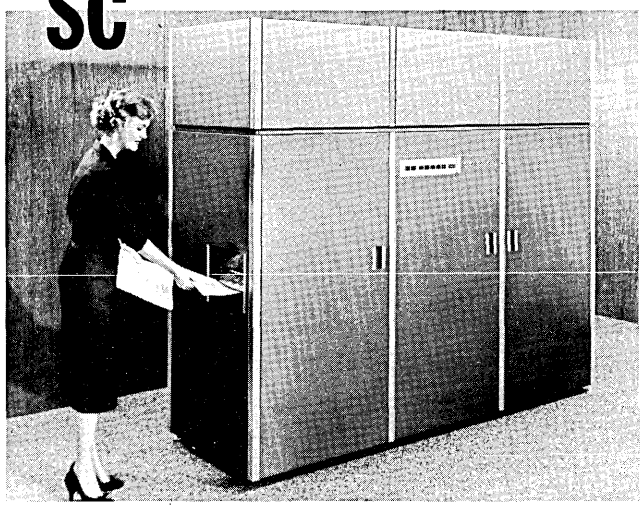
Printing up to 78,000 characters in a single minute on paper is the claim made for RemRand's UNIVAC printer. Operating on output tape, this unit offers a selection of 51 characters–letters, numbers and punctuation marks–on a 130-character-wide line. Printing is possible in any format desired, on sprocket-fed paper–either blank or preprinted – from four to 27 inches wide, and up to card stock in weight. Interchangeable plugboards provide complete control over the printed output. The printing system is composed of four separate units interconnected by cables. The tape reader is a modified clutch operated Uniservo, whose function is to convert information recorded on magnetic tape in the form of magnetic spots into a similar pattern of electrical pulses. The printing unit contains the operator's control panel, the electro-mechanical printing mechanism, and the paper feeding mechanism. The memory unit contains a cold cathode gas tube memory having a 120 digit capacity.

NCR



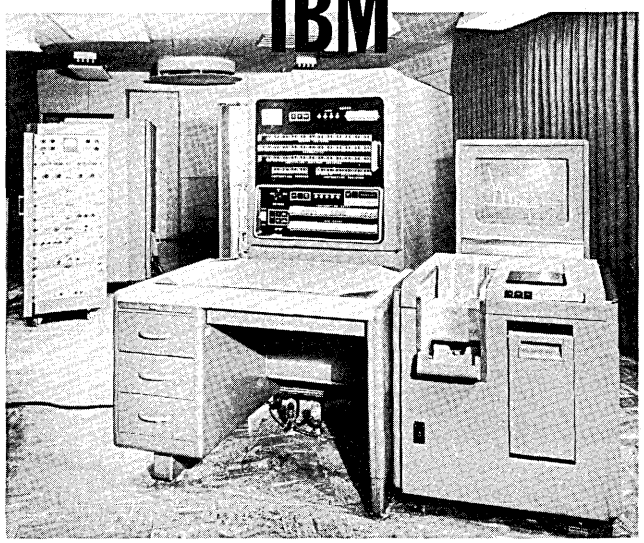
In the National Cash Register Printer, a helical track of needles is arranged around the surface of a drum. Directly over the drum, is a permeable bar. The magnetic field which places the image on the paper is established between the needle points and the bar. During the time that a particular needle point is passing under the bar, a magnetic flux path is established between the needle and the bar only when the coil is energized. Seven vertical scans are allotted for each character. The scan is energized for the full height of a given character if a full vertical line is to be recorded for that portion of the character; or the scan is energized for only a portion of the time as needed. The image is made visible by exposure to a ferromagnetic powder attracted to the magnetized portions of the paper. Heat is applied for fix. Pictured at left is a prototype unit.

SC



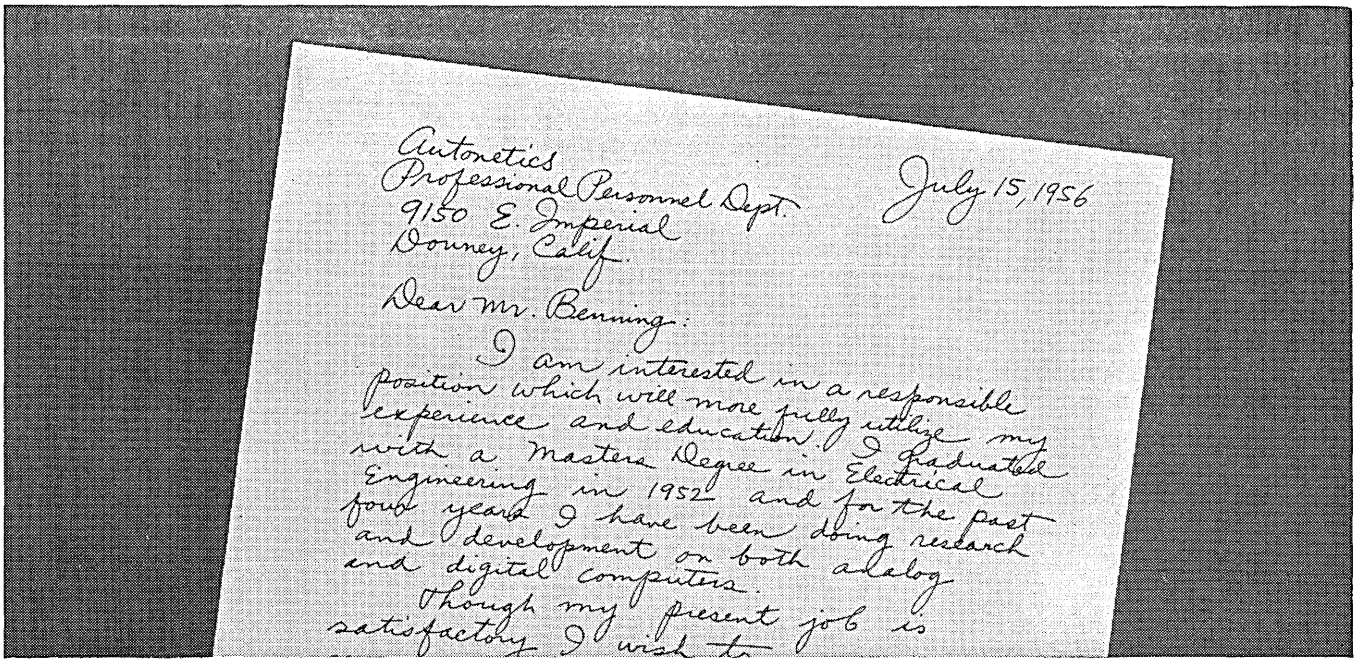
In the S-C 5000, electrical impulses from a computer are translated into a display of numbers, letters and symbols by means of the Charactron shaped beam tube. Inside the tube, which is similar to a TV picture tube, an electronic gun shoots its beam through tiny shaped openings which form the beam into characters. In the xerographic process, these characters are projected by an optical system onto the charged surface of a selenium drum. The latent images thus produced are developed by cascading a dry powder, oppositely charged, over the drum, and then printed on continuous rolls of paper. The seven-inch shaped beam tube reproduces 64 characters—the alphabet, numbers and 28 symbols. Stromberg-Carlson's unit will print computer output at a reported 4,680 lines per minute on rolls of paper, or on sheets cut to desired size.

IBM



International Business Machine's, cathode ray tube recorder displays information in graphic form by means of small dots on the face of the cathode ray tube. The digital-to-analog converter consists of two units, a 740 recorder and a 780 display, and is controlled by the stored program of the computer. The recorder contains a 7-in. cathode ray tube characterized by a raster consisting of 1,024 positions for the ordinate deflection and the same number for the abscissa deflection. The tube has a persistance of several microseconds and precise deflection traits. Its position stability is better than 0.1 percent and a maximum error of 0.5 percent positional accuracy is claimed. The display unit contains a 21-in. cathode ray tube which displays a raster similar to that in the recording unit tube. This unit is cable connected to the recorder. Data points are displayed on both tubes at a rate of better than 7,000 per second.

Circle 101 on Reader Service Card.



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Circle 6 on Reader Service Card.

magnetic tape reel

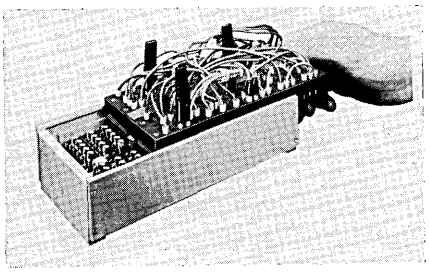
This instrumentation reel offers machined construction throughout, rigid flanges which are tapered for a low

amount of inertia, and a newly-designed, self-centering hub. It can be used on all conventional tape recorders. Employed in its manufacture is a tape-threading method which eliminates the conventional threading slot in the hub along with the resultant distortion of the tape when wound under high tension. Instead, a high-friction synthetic rubber ring bonded to the hub enables the tape to grip the reel with only a single turn by hand sufficient to "bury" the end of the tape. For information write MINNESOTA MINING AND MANUFACTURING CO., 900 Bush St., St. Paul 6, Minn. or use reader card.

Circle 150 on Reader Service Card.

programming system

A light-weight patchcord programming system designed for reprogramming of airborne circuitry, the 240

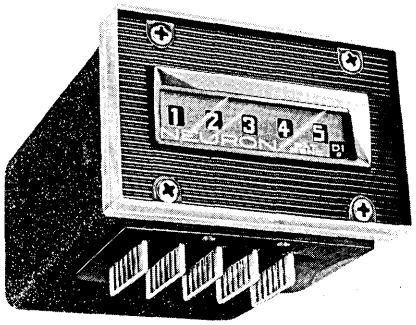


system, weighs 3¼ lbs. and has been miniaturized to conserve space. Removable, pre-patched boards make complete circuitry reprogramming possible in a matter of seconds. The unit itself is constructed of aluminum alloy and will withstand shock and vibration, according to the manufacturer. Seating of patchcord pins are also designed for shock resistance. For versatility of circuit combinations, the system contains 240 contact holes. For information write AMP, INC., Harrisburg, Penna. or use reader card.

Circle 151 on Reader Service Card.

switch readout counter

A 40-count-per-second, 5 digit readout counter offers a life of over 300,000,000 counts. The Neuron counter is in-

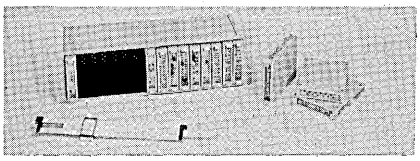


tended for military and industrial high vibration and extreme G-load applications. A unique bi-directional stepping mechanism for adding and subtracting will not double-index during shock, vibration or voltage surges. The counters are rapid-follow digital function indicators to provide position of almost any discrete variable or for storing in-out information for tabulation. The switch readout feature is an etched 10-point switch and circuit combination which makes each point on the switch externally available. For information write DATA INSTRUMENTS DIVISION, Telecomputing Corporation, 12838 Saticoy St., North Hollywood, Calif. or use reader card.

Circle 152 on Reader Service Card.

transistor building blocks

Data Blocs may be combined by a pluggable pin-jack system to rapidly produce special test equipment and

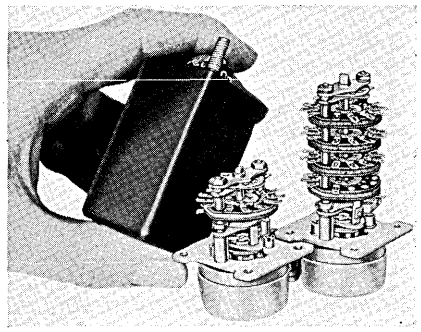


complete digital systems. The basic blocks can be reused any number of times to form special laboratory gear as needed. It is possible to rapidly assemble shift registers, counters, pulse generators, pattern generators and experimental prototypes in a brief time by the use of this system. The designs, based on large scale computer experience, afford a considerable saving in project time, manpower and reliability checkout in handling digital problems, the manufacturer states. For information write HARVEY-WELLS ELECTRONICS, INC., R&D Div., 5168 Washington Street, West Roxbury, Massachusetts or use reader card.

Circle 153 on Reader Service Card.

selector switch

Model BD2E rotary selector switch that holds up to four 12-position wafers and weighs 3½ oz. is now availa-

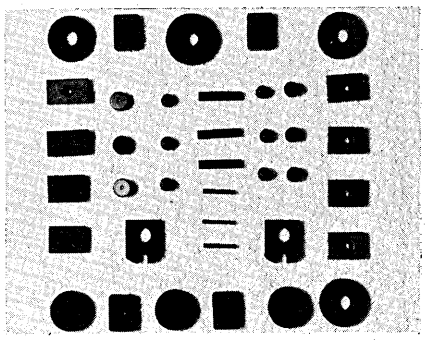


ble. It is actuated by a rotary solenoid weighing 2 oz., 1⅛ in. in diameter, as used in the Explorer I earth satellite. The remaining 1½ oz. includes indexing shaft, ratchet mechanism and four wafers. Maximum dimensions are 2-29/32 in. x 1⅜ in. x 1⅜ in. This new rotary stepping switch performs such switching jobs as stepping, counting, programming, circuit selecting and homing. Remotely controlled, it can be either self-stepped or externally impulsed and has a service life of 500,000 steps. Operating voltage is 3 to 300 vdc, and minimum pulse length is 20 milliseconds. For information write G. H. LELAND, INC., 123 Webster St., Dayton 2, Ohio or use reader service card.

Circle 154 on Reader Service Card.

ceramic permanent magnets

Barium ferrite, a permanent magnet material having what the manufacturer calls "extremely high coercive

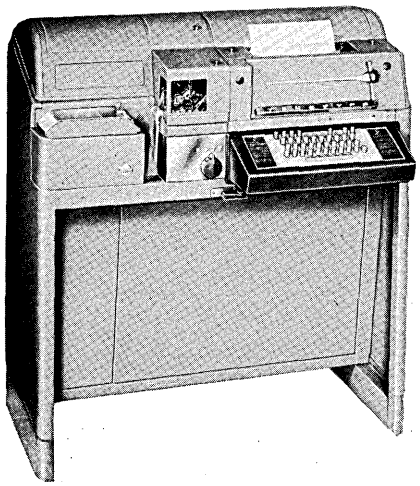


force" is now available. This inexpensive material can be formed into intricate shapes to close tolerances with no subsequent machining operations by conventional ceramic techniques. Literature, electrical property charts and drawings showing stock shapes are available. For information write D. M. STEWARD MANUFACTURING CO., Chattanooga, Tenn. or use card.

Circle 155 on Reader Service Card.

send-receive set

Providing facilities for typing, tape punching, tape transmission and tape reception, this set operates at 100

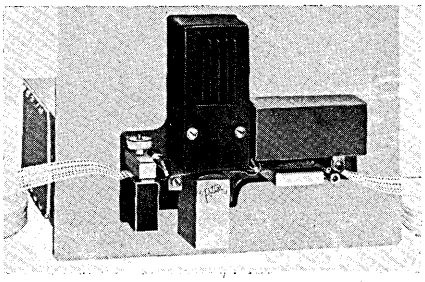


words-per-minute. The unit can also send and receive page copy on message paper or multi-part business forms, accommodate tape as a by product of both transmission and reception and provide a built-in control system for remote apparatus. Measurements: 39 in. high, 6 in. wide, 18½ in. deep with a keyboard projection of 4¼ in. For information write TELETYPE CORP., Dept. SP-1, 4100 Fullerton, Chicago 39, Ill. or use card.

Circle 156 on Reader Service Card.

tape strip reader

A completely transistorized perforated tape strip reader, the 909 is suitable for rack or console mounting. Some

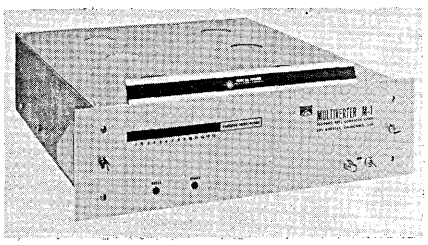


of its features — character reading speeds up to 1,000 characters per second, simple in-line threading, three millisecond starting time, stops on STOP character (0.2 millisecond) and will read next character after start, photo diode head reads any tape, ambient temperature up to 125° F with 10,000 hour life and it is not affected by temperature changes. For information write POTTER INSTRUMENT CO., INC., Sunnyside Blvd., Plainview, L. I., N. Y., or use card.

Circle 157 on Reader Service Card.

incremental multiverter

Model M-1 converts voltages to digits in a single high information channel at rates as high as 200,000 conversions

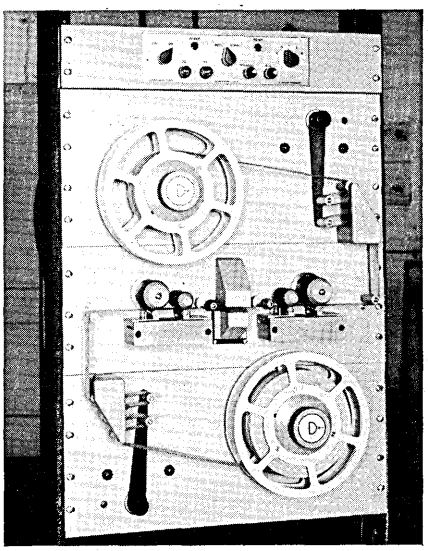


per second. The manufacturer states it will literally follow a single function on an incremental basis. A digital number is always present in the output register, with the change being entered every five microseconds (to accuracies of 0.01%). The counter used accepts three types of input: −1, + 1 and 0 (or no change). Variations of the basic M-1 can produce square roots or quotients in the conversion process. The multiverter is completely transistorized. For information write PACKARD-BELL COMPUTER CORP., 1905 S. Armacost Ave., Los Angeles 25, Calif., or use reader card.

Circle 158 on Reader Service Card.

tape reader

This perforated tape reader handles tape strips or reels with equal facility. It can operate at speeds up to 750



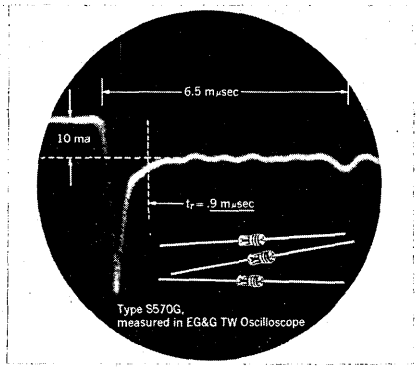
characters per second, with less than 5 milliseconds start or stop time. At 300 characters per second it stops in the space following the stop character. For 750 character per second operation, a two character stop space is recommended. All standard 5, 6, 7 or 8 level tapes (plus sprocket hole) are handled and 11/16 in., ⅞ in. or 1 in. wide tapes can be used interchangeably. Other characteristics include complete remote control of forward,

reverse, stop and speed change; and bi-directional operation of both reels and strips. For information write DIGITRONICS CORP., Albertson Ave., Albertson, Long Island, New York or use reader service card.

Circle 159 on Reader Service Card.

germanium diode

Switching time of .9 milli-microseconds has been achieved by a new germanium diode. The S570G is on the

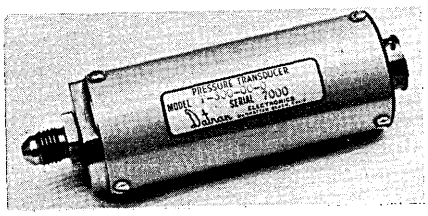


order of 50 times faster than other available computer diodes, according to the manufacturer. New manufacturing techniques have resulted in a stored charge (after a 10 ma forward current) smaller than that of a 3 micro-microfarad capacitor at 6 volts. Another diode, the S555G, is specified at 6 milli-microseconds and offers better dc characteristics. For information write TRANSITRON ELECTRONIC CORP., Wakefield, Massachusetts or use reader service card.

Circle 160 on Reader Service Card.

pressure-frequency transducer

This instrument is completely self-contained with only dc current required as input power. The basic

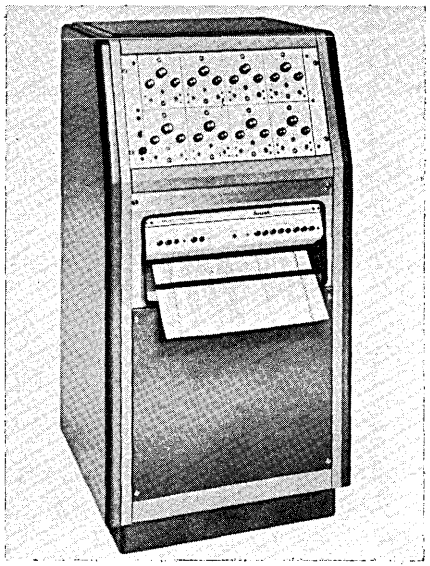


pressure sensing is accomplished by a variable inductance ac transducer, the transducer coil being part of an integral oscillator tank circuit. The instrument therefore has infinite resolution and provides repeatability of 1% or better. The pressure acting on either or both sides of a diaphragm causes the coil inductance to vary the oscillator frequency which can be pretuned by the factory to any of the 18 RDB sub-carrier telemetering channels from 400 cycles per second to 70 KC per second. For information write DATRAN ELECTRONICS, 1836 Rosecrans Ave., Manhattan Beach, Calif., or use reader service card.

Circle 161 on Reader Service Card.

recording system

An eight-channel, ultralinear recording system, model RD 1648 00, with rectilinear readout and thermal writ-

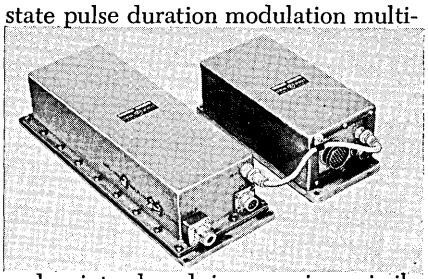


ing features a choice of two individual plug-in amplifiers. One amplifier in the medium gain dc system has a sensitivity of 10 millivolts per chart line (mm) with a stability better than ½ chart line per hour. The other amplifier has a stability of better than 1/10 chart line per hour and a sensitivity of 50 millivolts per chart line (mm). Thermal writing feature of the new system provides immediate traces, uniform both in density and width. There are eight standard chart speeds (.4 to 100 millimeters per second) and an accessory low speed range chart drive. For information write BRUSH INSTRUMENTS, 3405 Perkins Ave., Cleveland 14, Ohio or use card.

Circle 162 on Reader Service Card.

airborne telemeter

The 30 x 30 PDM/FM airborne telemeter is the first completely solid-state pulse duration modulation multi-

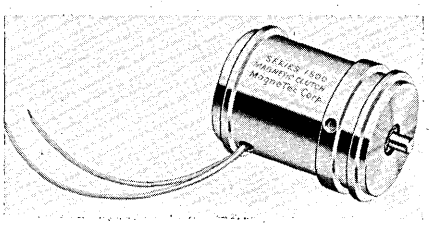


coder introduced in a major missile program. The multicoder, shown as the smaller package connected to its companion 7½ watt VHF/FM transmitter, is also available in all standard IRIG sampling configurations for PAM and PDM applications. No mechanical commutation is employed. The multicoder consists of a completely solid-state electronic commutator, keyer and power supply designed for 0 to + 5 V operation. Linearity is better than ¼ in. of 1%. For information write GENERAL DEVICES, INC., Princeton, N. J. or use reader card.

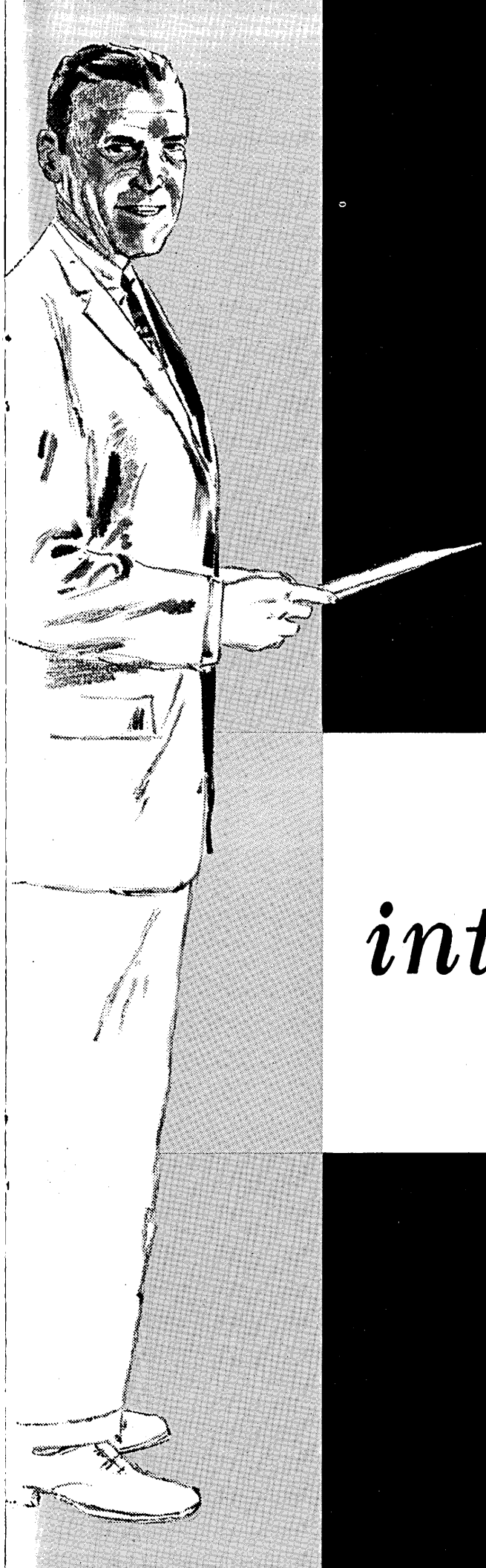
Circle 163 on Reader Service Card.

miniature magnetic clutch

Series 1500 clutches are available in double ended models with either servo or flange type mounting surfaces. Fea-



Circle 7 on Reader Service Card. →



introducing
a new, simplified
programming system for
the **Bendix G-15**
general purpose
digital computer

intercom 1000

EASY TO LEARN. Only four hours of training needed.

FASTEST SYSTEM OF ITS KIND in the G-15's price range.

PUNCHED CARD, PUNCHED TAPE, MAGNETIC TAPE, TYPEWRITER input-output. Up to 1,200,000 words of low-cost magnetic tape memory.

FIXED OR FLOATING DECIMAL POINT input-output. Numbers may be handled exactly as they occur in problems, without moving decimal point. No scaling.

FIVE OR TWELVE DIGIT ACCURACY with same commands.

INDEX REGISTERS enable commands to be written once, and repeated on different data automatically.

COMPLETE DEBUGGING facilities for fast check-out of new programs.

intercom 1000 ...all new...easy to le

GENERAL DESCRIPTION

If you can learn to use a desk calculator, you can learn to use an electronic computer...in just four hours. INTERCOM 1000 is a new system of writing computer instructions that makes this possible.

Developed especially for the Bendix G-15 General Purpose Digital Computer, this major advance in technique makes it truly practical to place a computer right in the office or laboratory. There it can be used by the men who know the problems best. The inefficiency of waiting for "computing center" solutions is eliminated.

INTERCOM 1000 is a complete general purpose system, in which commands and data may be stored in the computer's internal memory. Internally stored commands can be obeyed automatically.

Each INTERCOM 1000 command results in a number of internal operations. Much time is saved, and the programmer need know only the few commands shown on the opposite page. This "command list" is short enough to be easy to understand and use, yet complete enough to give the user unusual versatility.

Each INTERCOM 1000 command is represented by a two-digit code. To write an instruction, the user need only specify the desired code, together with the four-digit memory address where he has previously stored the data on which he wishes to operate.

The portion of an INTERCOM program shown below illustrates the simplicity of problem preparation for the G-15. This program is for the calculation of

$$\frac{a^2-bc}{d}$$

where a, b, c and d are stored in memory positions 1100, 1101, 1102 and 1103 respectively. Each operation is performed on the contents of an arithmetic register called the accumulator, and the answer appears in the accumulator.

NOTES	Command Code	Memory Address
Clear accumulator and add b	42	1101
Multiply b, in accumulator, by c	44	1102
Store bc	49	1104
Clear accumulator and add a	42	1100
Multiply a, in accumulator by a	44	1100
Subtract bc from a^2	41	1104
Divide a^2-bc, in accumulator by d	48	1103

Subroutines to calculate trigonometric, logarithmic, exponential and other functions are integral parts of INTERCOM 1000 and may be automatically inserted in any selected portion of the memory. The calculation of any subroutine function may then be called for in a program with a single command. For example, the two commands below, added to the preceding program, would enable the computation in radians of

$$\sin\sqrt{\frac{a^2-bc}{d}}$$

NOTES	Command Code	Memory Address
Perform square root subroutine, which begins at address 1597. Leave result in accumulator.	08	1597
Perform sine subroutine, which begins at address 1442. Leave result in accumulator.	08	1442

VERSATILE COMMANDS

Although the INTERCOM 1000 command list is simple, it is complete. For example, conditional transfers of control may be based on a variety of conditions, as shown in the command list. By a single command, the contents of any memory location may be typed out in fixed or floating decimal point form.

Index registers provide facilities for writing a single set of commands which will operate automatically on different sets of data. This "address modification" feature, which can eliminate many repetitive program steps, is another reason why INTERCOM 1000 is so easy to use.

Carriage returns and tab stops can be programmed as part of the typewriter output commands. A single command is available for adjustment of the typewriter paper to any position. This feature is useful when output is to be typed in assigned spaces on a form, or in any special composition. No plugboard wiring is required.

INPUT-OUTPUT

One of INTERCOM 1000's important features is its ability to accept data for the computer without any adjustment of decimal points. With most other computers, numbers must have their decimal points moved to the far left or the numbers must be translated into an entirely different number system. With INTERCOM 1000, the number 36.052, for example, is entered into the computer in exactly that form, 36.052. Answers are also returned with the decimal point in the normal position. No scaling is required in this type of fixed point input and output.

Numbers may also be fed in and out of the computer in floating decimal point notation, with a positive or negative range of magnitude from 10^{-38} to 10^{38}. This range is far larger than that of any other computer in the G-15's class.

Input and output are accomplished by the computer's typewriter, paper tape punch, and high speed photoelectric paper tape reader. Punched card input-output, and magnetic tape units are available.

o learn and use

Up to four Bendix Magnetic tape units may be used, each providing 300,000 words of low-cost auxiliary storage. Commands are provided to read from and write on tape, write file number, search for file number, and reverse tape. Each file may consist of any number of blocks of 100 words each.

Commands for reading and punching cards are available for use when a card accessory is employed.

COMPUTATION

All internal computation is carried out in floating point form with a magnitude ranging from 10^{-38} to 10^{38}. The high upper limit of INTERCOM 1000 greatly reduces the possibility of overflow in computation, while the low bottom limit assures that numbers of very small magnitude will not be lost in computation.

INTERCOM 1000 is faster than any floating point system in the G-15 price range.

The programmer has a choice of five or twelve digit accuracy, using the same commands. The five digit system gives additional internal memory space for program and data, where higher accuracy is not required.

A command may be obeyed from internal storage or may be typed on the typewriter and directly executed. No plugboards, pegboards, or other mechanical program devices are required with the G-15.

PROGRAM CHECKOUT

Complete facilities are provided for "debugging" a new program. The operator may execute one command at a time, or query the computer to obtain operating information. A program may be executed automatically with individual commands typed out where desired. Changes may easily be made in the program from the typewriter keyboard. The computer can be told to automatically type out the commands of an INTERCOM 1000 program in flow chart form.

OTHER METHODS

INTERCOM 1000 has been developed for those who need and want the advantages of electronic computation but not the costs and administration problems of computing centers, large staffs of computer specialists, and extensive employee training programs.

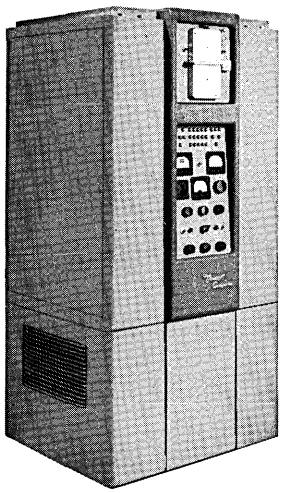
Some firms have problems of such complexity that they *do* need computer experts on their staff. They too will appreciate the G-15, because of the versatility of its basic programming system. Programmers with more sophisticated needs will find that commands are available for complete control over every internal operation of the computer.

The G-15, alone in its class, offers programming systems best suited to every user. This versatility also means expandability. G-15 users find that as their problems and abilities grow in sophistication, they need only to change their methods of use, rather than purchase more expensive equipment.

Pull through staples to keep for permanent reference

command list

CODE	COMMAND
	ARITHMETIC
42	Clear and Add
43	Add
40	Clear and Subtract
41	Subtract
44	Multiply
48	Divide
47	Inverse Divide
49	Store
45	Clear and Add Absolute Value
	TRANSFER OF CONTROL
29	Transfer Control Unconditionally
20	Transfer Control if Accumulator Positive or Zero
22	Transfer Control if Accumulator Negative
23	Transfer Control if Accumulator Zero
26	Mark Place and Transfer I
28	Mark Place and Transfer II
16	Return to Marked Place I
18	Return to Marked Place II
	INPUT OUTPUT
55	Read Punched Tape
51	Permit Fixed Point Data Type-in
52	Permit Floating Point Data Type-in
50	Permit Command Type-in
39	Punch Paper Tape
33	Type Fixed Point Number and Tab
38	Type Fixed Point Number and Return Carriage
32	Type Floating Point Number and Tab
34	Type Floating Point Number and Return Carriage
30	Position Typewriter Paper
31	Type Tabulating Number
	Additional Commands are available for use of magnetic tape and punched card accessories. See Text.
	SPECIAL COMMANDS
63	Ring Bell
67	Halt and Permit Manual Operation
68	Breakpoint Halt
69	Compute Automatically
08	Perform Subroutine
35	Type Command from Memory
06	Type Location of Last Command Executed
	INDEX REGISTERS
70	Assign Word Base
71	Assign Word Difference
72	Assign Word Limit
73	Assign Channel Base
74	Assign Channel Difference
75	Assign Channel Limit
76	Increment Word Base
77	Increment Channel Base



about the G-15

The G-15 is a general purpose digital computer. Low in cost and of medium speed, it is useful for an almost unlimited range of applications. Its physical size has been kept small by the use of serial logic and time sharing techniques in internal design.

The basic price of the computer includes an electric typewriter for input, output and control, a high-speed photo-electric paper tape reader, and a paper tape punch. Punched card equipment and magnetic tape memory units may be obtained as accessories. Special accessories include an inexpensive device which enables the computer to perform as a digital differential analyzer, for direct solution of differential equations.

G-15s are available on either a lease or purchase basis. For detailed specifications and applications data, contact the Bendix Computer office nearest you. You will be surprised at the low-cost and simplicity of electronic computation with the G-15, already serving scores of progressive businesses, large and small, throughout the world.

Bendix Computer

DIVISION OF BENDIX AVIATION CORPORATION, LOS ANGELES, CALIF.

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CHICAGO
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Washington 6, D.C.
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Telephone PArkway 8-1761

OTHER COUNTRIES
Bendix International Division
205 East 42nd Street
New York 17, New York
Telephone MUrrayhill 3-1100

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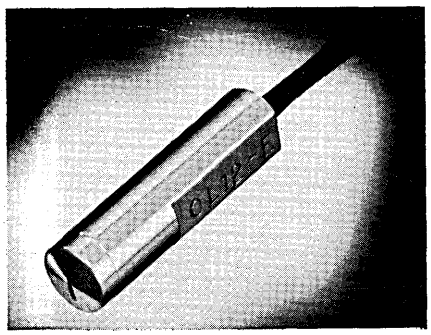
tures include fast response and torque values up to 100 in.-oz. with torque in completely disengaged position. Engagement can be accomplished without axial movement of either input or output shaft. Design features are adaptable to high vibration and shock conditions. Sizes ½ in. to 3 in. in diameter. For information write MAGNETEC CORP., 11785 Olympic Boulevard, Los Angeles 64, California or use reader service card.

Circle 164 on Reader Service Card.

magnetic memory drums

A small, lightweight, aluminum magnetic drum head, ⅜ in. in diameter by 1⅛ in. long, and .024 track width

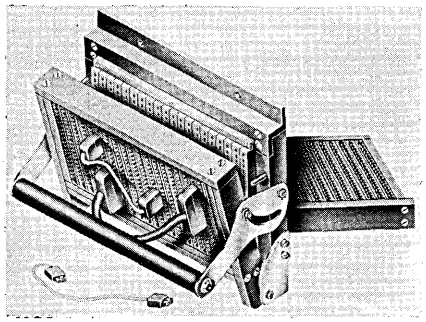


is now in production. The OL-12-E features balanced low impedance windings, low record current and high playback voltage for use with transistorized circuits. Bit densities of up to 200 bits per inch at 1 mil spacing; read and record information at high frequencies. Other features include all-metal construction, continuous operations at high temperature, milled flat perpendicular to gap. For information write MIDWESTERN INSTRUMENTS, Data Storage Devices Div., P. O. Box 7189, Tulsa, Oklahoma or use reader service card.

Circle 165 on Reader Service Card.

patchcord programming system

This system is an extension of multiple contact connectors beyond the point where such connectors can be

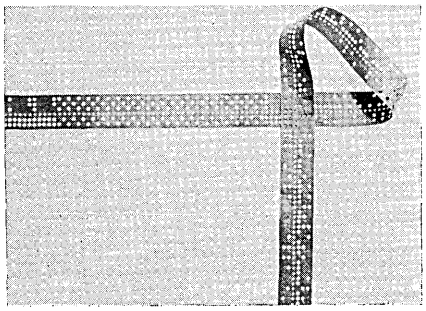


used manually. The flexibility of the system is a result of the modular arrangement of specially designed contact strips of 22 contacts and the fact that the programming may be accomplished by the use of single patchcords, multiple contact patchcords or permanent wiring. In the case of permanent programming it is perfectly feasible to wire in such resistors, capacitors, etc., as may be required for certain specific uses without increasing the size of the programming board in any way. For information write VIRGINIA ELECTRONICS CO., INC., River Road and B. & O. Railroad, Washington 16, D. C.

Circle 166 on Reader Service Card.

control tape

A thin, vulcanized fibre tape, designed for use on tape controlled automatic programming equipment, is made of

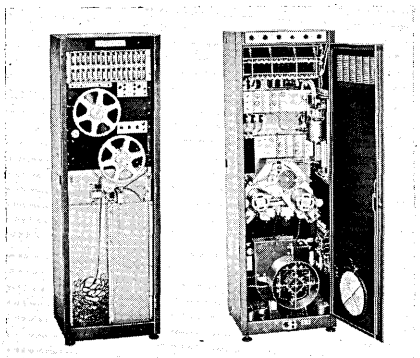


.005-in. thick slate gray vulcanized fibre. This cellulose plastic tape has a tensile strength of better than 600 psi, high density, low porosity, excellent abrasion resistance and is easily punched, the manufacturer claims. Other contentions – it will not stretch out of shape during use and it produces a minimum of wear on the perforating and feeding equipment associated with tape control applications. For information write NATIONAL VULCANIZED FIBRE CO., 1058 Beech Street, Wilmington 99, Delaware or use reader service card.

Circle 167 on Reader Service Card.

tape transport system

Now available is model 424 fully-transistorized tape transport system, a data recording system which records,

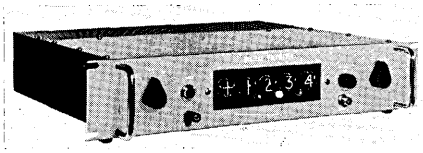


stores and reproduces analog or digital data. Two independent capstan drives with high speed start-stop times of less than 2 milliseconds, permit tape to operate in either direction at speeds from 60 ips to 150 ips. Tape widths from ¼ to 2 in., storage bins for 3,000 in. of tape, modular construction and moderate power dissipation are listed as outstanding features. For information write D. G. C. HARE CO., 30 Burtis Ave., New Canaan, Connecticut or use reader card.

Circle 168 on Reader Service Card.

digital voltmeter

Model 406 provides a quick means of measuring both AC voltages to .1% and DC measurements within ± 1



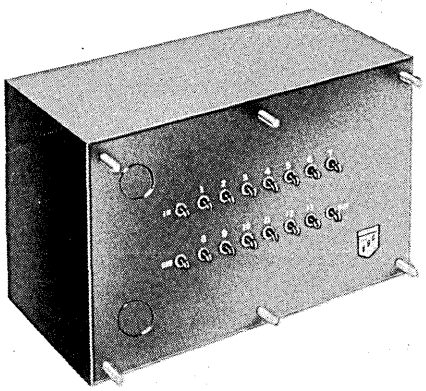
← *Circle 7 on Reader Service Card.*

digit. Selection of AC or DC operation is accomplished by turning a front panel switch. Complete plug-in packaging of all major units is available in either rack mounted or portable models. For information write ZINN INSTRUMENTS, 213 S. Hawthorne Blvd., Hawthorne, Calif.

Circle 169 on Reader Service Card.

delay line

This manufacturer reports that the extended bandwidth lumped-constant delay line virtually triples the delay-



to-rise-time ratio previously available with any delay line. Its 145-to-1 ratio now enables computer engineers to design delay line memories with 72 bit storage capacity rather than 25. Size has not been sacrificed in reaching the above mentioned ratio, achieved through the use of advanced design techniques and high Q inductors. The unit measures 3 in. x 4½ in. x 8½ in. The temperature coefficient of delay is less than 65 ppm per degrees C and can be improved considerably. For information write ESC CORPORATION, 534 Bergen Blvd., Palisades Park, N. J. or use card.

Circle 170 on Reader Service Card.

card filing machine

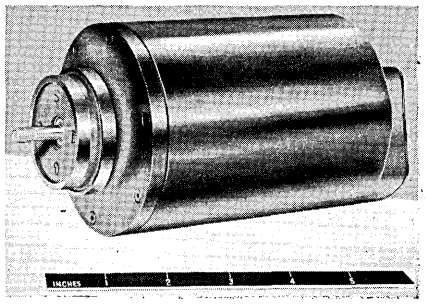
The 88 Collator arranges punched cards in any desired sequence at speeds better than 2½ times faster

than previous machines manufactured by this company. Its principal function is to compare two files of punched cards simultaneously in order that the cards can be matched, merged, selected and sequence-checked for subsequent accounting operations. Cards are entered into the machine from card feeding devices at each end. The main feed consists of a file feed device that can hold up to 3,600 cards, and the secondary feed is a conventional card hopper. Cards enter from each feed device at the rate of 650 per minute, so that with both feeds in use, up to 1,300 cards per minute can be processed. For information write International Business Machines Corp., Data Processing Div., 112 East Post Rd., White Plains, N. Y. or use reader card.

Circle 171 on Reader Service Card.

digital shaft-angle encoder

Model DV-13A contains a built-in alignment cell for establishing optical-mechanical concentricity precise to

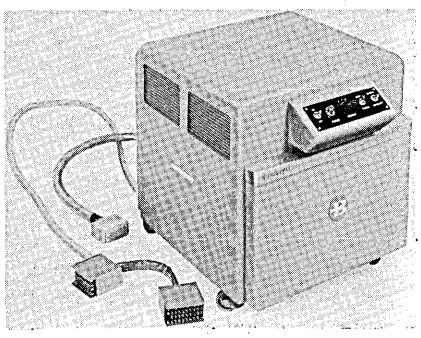


110 parts per million. The entire mechanical structure of this instrument is first assembled, and the bearings preloaded in the exact mechanical environment in which they will operate. The critical coding disk is then installed, mechanically aligned through a sensitive phase-measurement procedure, and then sealed permanently in place. Accuracy of shaft-angle indication can now be realistically held to better than ±2.5 minutes of arc. At 366 rpm, the probability of a 1-bit error, representing only a ±1.3 minute maximum angular error, is 0.75. Read-out is possible up to a maximum reading rate of 100 complete digital words per second. For information write DYCHRO CORPORATION, 125 Mt. Auburn St., Watertown 72, Massachusetts or use reader service card.

Circle 172 on Reader Service Card.

punched card input unit

Using this unit, a programmer can read separate or intermixed data and instructions into the manufacturer's



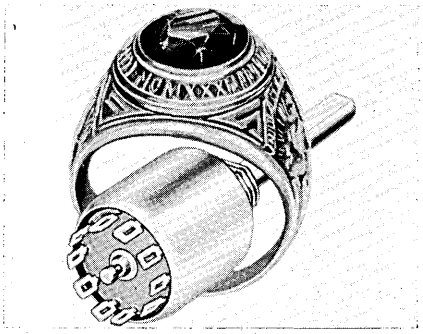
desk-size digital computer from information in punched cards. Cable-connected to the computer for simple removal and hookup, the unit is used in conjunction with modified versions of standard card keypunches. Positioning an automatic-to-manual switch allows the operator to choose whether data or instructions will be read directly from punched cards or taken from the keypunch's keyboard. Instructions entered manually from the keypunch can be simultaneously punched into cards, allowing the pro-

grammer to prepare his program deck as he tests out the instructions. For information write BURROUGHS CORP., ElectroData Div., 450 Sierra Madre Villa, Pasadena, California or use reader service card.

Circle 173 on Reader Service Card.

circuit selector switch

One-half in. in diameter, this switch weighs ⅓ oz. and has been extensively tested under extremes of temperature,



humidity, corrosion, vibration, acceleration, shock and immersion. All metal parts are fabricated from corrosion-resistant materials. Phenolics are heavily filled with non-organic fibres capable of withstanding high temperatures. Sixteen shorting and seven non-shorting switching arrangements are presently available in the series G (typical is a switch with one pole and up to 10 positions shorting). For information write The DAVEN CO., Livingston, N. J. or use reader service card.

Circle 174 on Reader Service Card.

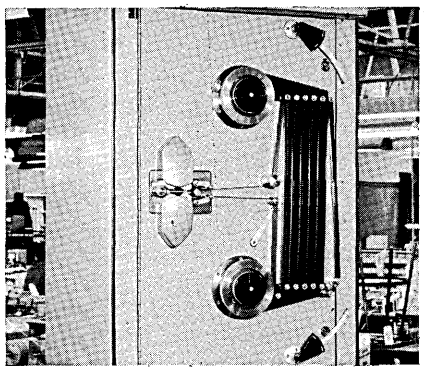
buffer memory system

A new buffer memory operates in ambient temperature conditions between 15° and 50° C which allows a greater degree of latitude under extreme climatic conditions. The maximum rate of operation is 100,000 cycles per second, load or unload operation and the unit is available with random or sequential type access. The circuits are all solid state. Model 144M4A, is a 144 character, 4 "bit" sequential-in, sequential-out buffer memory; however, the size can be varied either in number of characters or number of "bits" per character. Initial application of the 144M4A will be as a time buffer between equipments of different operational speeds. The memory is self-contained, including a power supply, address counters, output register, drive circuits and timing generator as well as the required number of memory planes determined by the actual character length. Its design permits mounting in a standard relay rack where its 5 in. height and 14 in. depth utilize a minimum of space — approximately ¾ of a cubic foot. The use of 100 germanium transistors and 350 germanium diodes contributes to the compactness of the unit. For information write GENERAL CERAMICS CORP., Keasbey, N. J.

Circle 175 on Reader Service Card.

tape loop adapter

Detailed repetitive spectrum analyses of information recorded on magnetic tape are now possible with this unit.

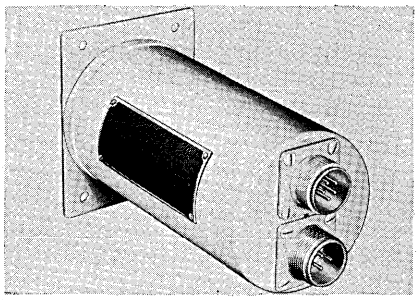


The continuous loop adapter permits study of transients in rocket engine tests, wave analyses by means of time compression, and similar operations. The adapter can be attached with a screwdriver. Its upper and lower arms are adjustable to accommodate loop lengths from two to 26 ft. Three models are available for standard instrumentation tape widths of ¼—, ½—or one-inch. For information write Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.

Circle 176 on Reader Service Card.

frequency converter

This fully transistorized unit converts a-c signals into either d-c voltages or amplified pulse outputs and occupies

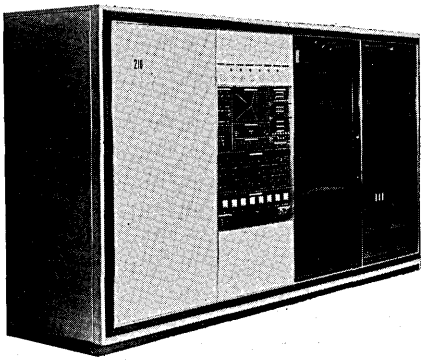


less than half the space of conventional designs. The converter is made for both ac and dc power supplies and has a wide full scale range adjustment. Full scale input frequency is adjustable from 300 to 900 cps with a minimum frequency of 10 cps. Output voltage is 0-5 v dc into a 500,000 ohm load; 0-100 mv dc into a 10,000 ohm load; or 0-50 mv dc into a 5,000 ohm load. For information write FISCHER AND PORTER CO., 752 Jacksonville Rd., Hatboro Penna. or use card.

Circle 177 on Reader Service Card.

data logger

The manufacturer is providing a complex data processing system for use at the NACA Langley Aeronautical



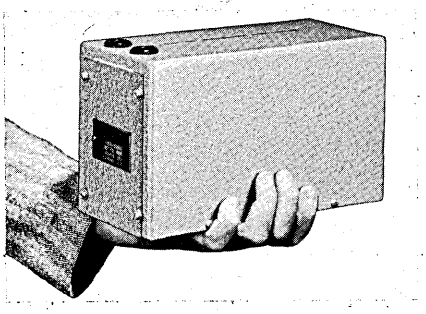
Laboratory at Langley Field, Va. Model 210 will be capable of sampling wind tunnel information at the rate of 3,000 signals per second. The information from transducers within the tunnel being served will be fed to the system and recorded as tem-

peratures, pressures, flows, shaft positions and other variables. The system is being built entirely around solid-state components to assure the utmost in reliability. For information write BECKMAN SYSTEMS, 325 N. Muller Ave., Anaheim, Calif. or use card.

Circle 178 on Reader Service Card.

voltage regulators

These automatic line voltage regulators, suitable for computer use, are completely independent of load from



0 to 100% of rated value, and are unaffected by input frequency variations over at least the range of 45 to 65 cps. The output wave-form of these regulators is a perfect reproduction of the input with no harmonics added. Correction is extremely fast, generally occuring within three cycles. Units are available for single phase or three-phase inputs of 115 or 230 volts nominally, with outputs from 575VA to 2300VA. For information write BRITISH INDUSTRIES CORP., 80 Shore Rd., Port Washington, N. Y. or use card.

Circle 179 on Reader Service Card.

photojunction cell

An ultra-miniature photojunction cell for use in computer, punched-tape, punched-card and other applications is now available. The RCA 7223 has a diameter of 0.08 of an inch and an overall length (excluding flexible leads) of 0.52 of an inch. One hundred and fifty cells weigh slightly less than one ounce. Design features of the 7223 include fast rise and decay characteristics, an illumination sensitivity of 0.2 microampere per footcandle and a power-dissipation capability of 0.025 watt. Spectral response of the 7223 covers the range from about 3,500 to nearly 19,000 angstroms. Maximum response occurs at about 15,000 angstroms, giving the cell high sensitivity to red and infrared radiation as well as good response across the visible region of the spectrum. For information write RCA, Electron Tube Div., Harrison, N. J. or use card.

Circle 180 on Reader Service Card.

magnetic amplifier

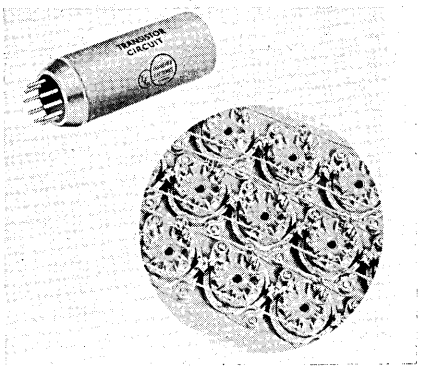
Model 701 relay magnetic amplifier operates on less than three microwatts of dc control power and delivers 0.4

watts of output power. This unit makes it possible to operate small power relays from low energy sources such as photoelectric cells, null detectors, and thermocouples with excellent reliability and accuracy despite extreme shock, vibration and temperature. A special feature of the amplifier is that it is connectable as either a linear amplifier or as a bistable amplifier. Further, with minor external circuit changes, it can operate as a memory device, as a time delay unit, or as a logic device. The new 701 relay amplifier operates from 26 volts at 400 CPS and is recommended for aircraft, missile and industrial applications where excellent reliability and good sensitivity are required. The new unit weighs less than 6 ounces and is conveniently packaged in a hermetically sealed, plug in, ruggedized container. For information write ACROMAG, INC., 22519 Telegraph Rd., Detroit 41, Mich. or use card.

Circle 181 on Reader Service Card.

transistor circuits

These plug-in circuits are for application in timing, control and computer systems and feature complete inter-circuit compatibility. The circuits are totally enclosed in a metal case 7/8" in diameter with a seated height of 2 3/16 inches. When mounted with

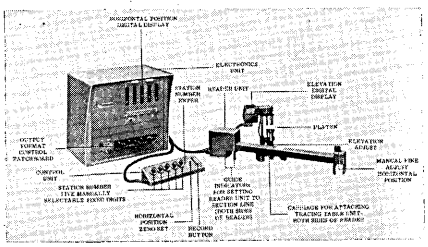


the recommended 1 inch spacing, the total space required is 1 square inch per case or 2.18 cubic inches per case. Cases may contain more than one circuit, are not potted, and can be opened without special tools for repairs if necessary. No non-standard punching or expensive connectors are required. For information write ENGINEERED ELECTRONICS CO., P. O. Box 659, Santa Ana, California.

Circle 182 on Reader Service Card.

graphic to digital translator

The Terrain Data Translator consists of two parts, a first-order precision reading unit and an electronic count-



er. Two-axis output can be in the form of punched paper tape, punched cards or hard copy. Resolution of 1,000 counts per inch, push-button choice of zero position, true positive and negative numbers about the zero point are claimed by the manufacturer. An extensive output format control patchboard permits the user to tailor the machine's output to the specific problem at hand. For information write BENSON-LEHNER CORP., 11930 Olympic Blvd., Los Angeles 64, California or use reader card.

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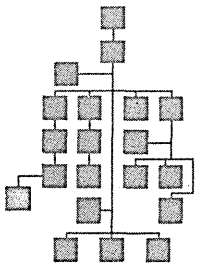


people moving up in DATAMATION

Thompson Products, Inc., and its affiliate, the Ramo-Wooldridge Corp. have signed an agreement providing for merger. The resulting company, the Thompson Ramo Wooldridge Corp. has as its board chairman and chief executive officer **J. D. Wright,** former Thompson president. **Dr. Dean E. Wooldridge** is president and **Dr. Simon Ramo** is executive vice-president. . . . **Dr. Richard W. Hamming,** ACM president, has named **Professor John W. Carr, III,** as ACM representative to the Council of the American Association for the Advancement of Science, and **Dr. Jack Moshman** as ACM rep to the Division of Mathematics of the National Research Council. Both appointments are for two year terms. . . . In New York, IBM made a vice-president of **McLain B. Smith,** assistant general manager of the company's data processing division.

Dr. Saul Rosen has been named to the newly created position of manager, programming research and development for Philco Corporation's Transac computers. Also, **Lloyd Gainey** is now manager of Transac field service engineering in Philco's G and I Div. . . . The Berkeley division of Beckman Instruments, Inc., has established new offices in Mountainside, N. J. (manager—**Austin F. Marx**) and Chicago (**James K. Turke, Jr.,** manager). . . . The newly-formed Manhattan Physical Research Group, Inc., has as its first president ACM, PGEC and IRE member **Cyrus Adler.** MPRG veep is **Gerard G. Harris.** The firm is an independent research service in the New York area.

Now director of Hughes Aircraft Company's data processing laboratory is **John W. Bozeman** who holds more than 30 patents. He came to Hughes in 1955 as an engineer in ground systems and subsequently was named head of the data processing department. . . . **Franklyn E. Farris** has been named eastern regional manager of field services for Data-Control Systems, Inc., Danbury, Conn. He was formerly product manager with Phillips Electronics, Inc. . . . **Reid Anderson,** formerly director of physical research at NCR, Dayton, has joined Stanford Research Institute as manager of the computer laboratory.

Harry D. Huskey, Ph.D., associate professor in electrical engineering and mathematics at the Univ. of California, is coordinating the activities of a newly formed Advanced Programming Development Group for Bendix Computer. Dr. Huskey is largely responsible for the logic design of the G-15. . . . **John F. Brinster,** well-known authority in the development of data recording devices for aircraft and space missiles, was honored with an Achievement Award presented by Princeton Univ. Class of '43. . . . **David P. Perry** has been appointed senior engineer at Potter Instrument Co., Plainview, N. Y.

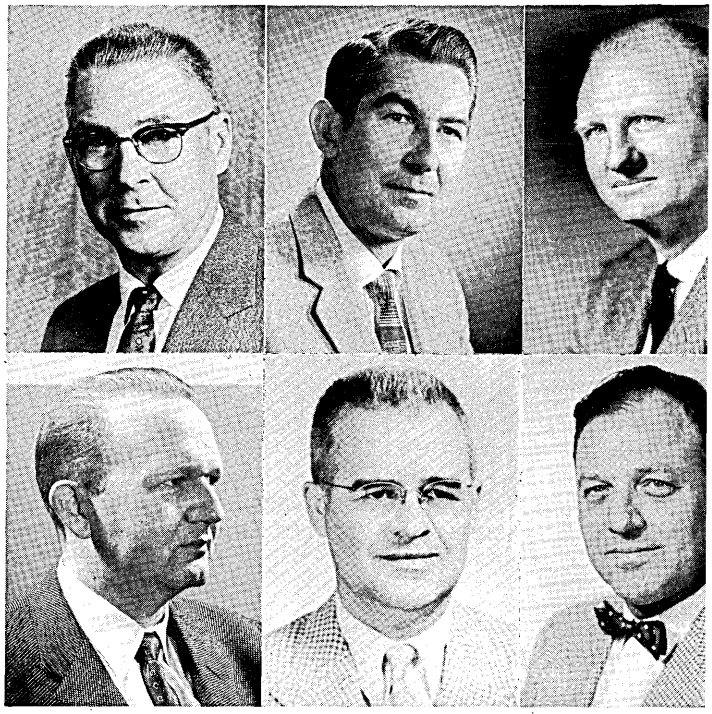
Appointment of **Robert T. Blakeley** as corporate staff engineer has been announced by Burroughs Corp. He will assist **Dr. Irven Travis** in planning the engineering program for the series G high speed printing and tabulating machine. Blakely's office will be at Control Instrument Co., Brooklyn, N. Y. . . . **Albert Diamond** is now project engineer, advanced design at Norden-Ketay Corp., precision components division. Diamond will be responsible for R&D of data and control transmission instrumentation.

New sales manager of the DataTape Div., Consolidated Electrodynamics Corp. is **Harold S. Davis.** He was formerly sales manager, sales engineer and marketing manager at American Electronics. . . . **Laurence R. Brown** has been named a senior associate with Briggs Associates, Inc. He was formerly technical coordinator of research with Burroughs and Philco. . . . Auerbach Electronics Corp. of Narberth, Pa., data processing specialists, announced the appointments of **Irving Glassman** as senior project manager and **Robert B. Dixon** as senior member of the technical staff. Glassman had developed a digital data reduction system at Franklin Institute prior to joining the company.

J. D. Wright
Thompson Ramo Wooldridge

John Bozeman
Hughes Data Processing

Robert Blakely
Engineer, Burroughs Corporation



Dr. Saul Rosen
PR&D Manager, Philco Corporation

Dr. H. D. Huskey
Bendix Computer Division

Harold Davis
Consolidated's DataTape Division

AUTOMATIC ERROR CORRECTION - - NOW

datamatic announces orthotronic control

Discovery of a method to insure virtually uninterrupted accuracy in electronic data processing by correcting mistakes "on the fly" at electronic speeds has been claimed by the DATAmatic Division of Minneapolis-Honeywell.

The new system, called Orthotronic Control, literally re-creates source data and provides instant data reconstruction of lost or garbled words or figures when discrepancies are automatically spotted at any one of a series of checkpoints throughout the system.

"This development," said Paul B. Wishart, president of Minneapolis-Honeywell, "now makes systems capable of correcting mistakes with no interruption of work, with no human intervention and with no slackening of operations."

The word "Orthotronic" is derived from the Greek word "ortho," meaning straight, right, true or correct, and the final six letters of the word "electronic."

The system has been started in production at DATAmatic's two plants near Boston, and will be ready for service with exisiting and future Datamatic 1000 systems in the second quarter of 1959, the company announced.

DATAmatic contends that Orthotronic Control meets a long-felt need in the industry for replacing the expensive manual correction of error.

Many systems today have built-in detection methods by which the machine in effect proof-reads its own material and may ring a bell, flash a light, or otherwise say "I have found an error in the copy." Until Orthotronic Control, DATAmatic states, this has then required manual searching of the files or re-runs of the tape.

OC's non-stop retrieval of data, although requiring no human intervention, will relay to the operator a typed note informing him that a passing mistake has been discovered and corrected.

The development of this error correction system is expected to have wide application in other areas, notably in communications, the company said.

explaining orthotronic control

Richard M. Bloch (see profile, this page) is director of product development at DATAmatic. He recently prepared a report explaining how Orthotronic Control operates. The complete report follows.

Although mine is a specialized profession, dealing with matters and problems sometimes difficult to understand without previous background and training, I will do my best to explain what it is we have accomplished in developing the Orthotronic Control system to be put into practice in the equipment of our DATAmatic line. Also, I will explain something of how it is accomplished.

Orthotronic Control represents an advanced step in data-processing systems engineering.

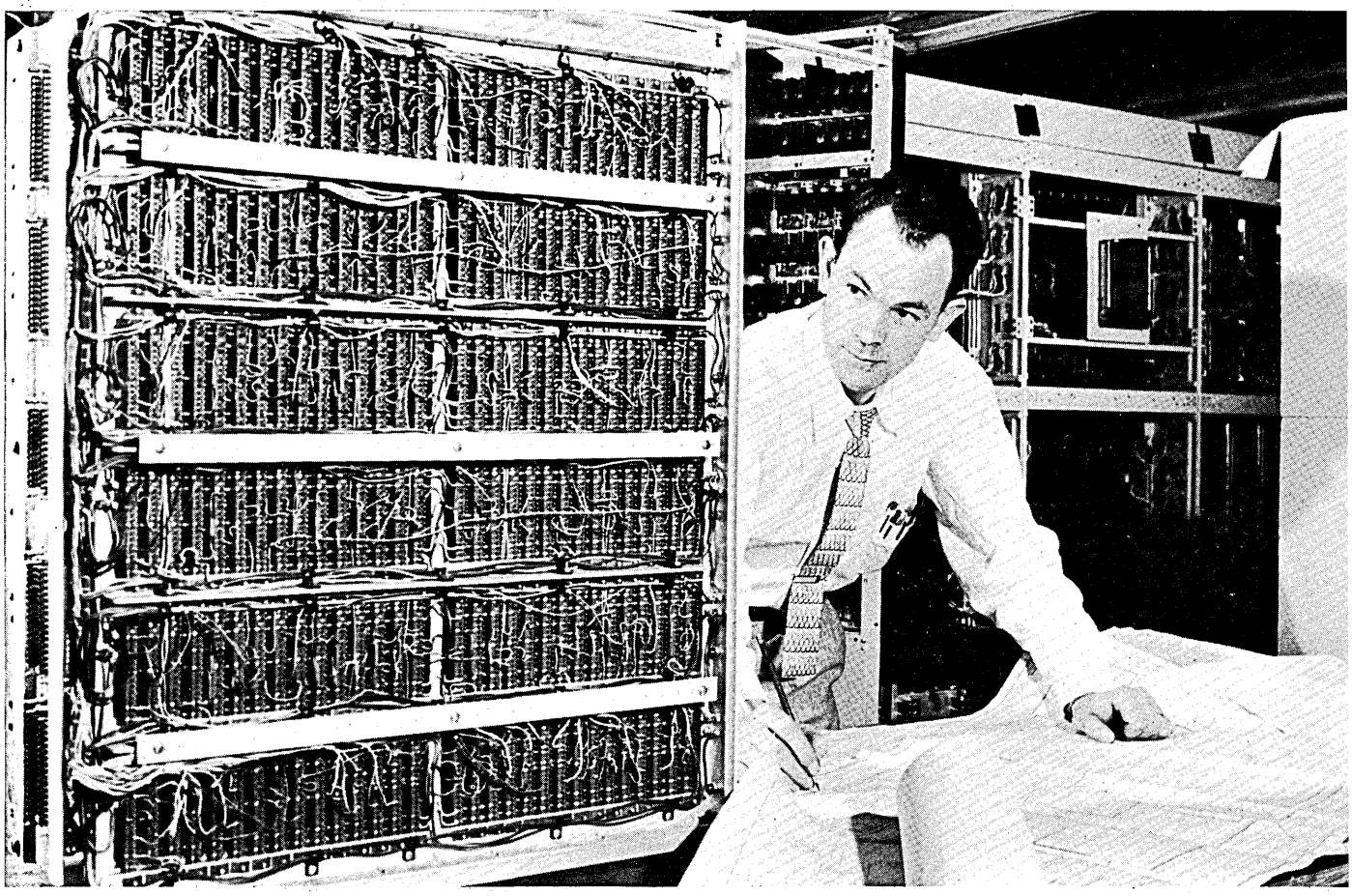
Previously, all data-processing systems have had one form or another of automatic checking features enabling the data processors to detect any error which had been made by the system. Orthotronic Control proceeds an important step further because it enables the system itself to correct errors a split second after it has detected them. Furthermore, this is accomplished automatically, with no stoppage of the work of the system, and with no human intervention required.

Orthotronic Control monitors two areas of the entire Datamatic 1000 system. These are the input and output main trunks of the system. They are what their names imply. They include the areas controlling the transmission of information from the output buffers (or storage areas) of the system to the recording circuitry, the recording circuitry itself, the magnetic tape, the magnetic head which subsequently reads the tape, the circuitry involved in the reading, and the transmission of this information into the input buffer channels of the system.

How this system works, I will try to explain in terms of how it is applied to our own system, the Datamatic 1000 for which it was perfected.

When information is written on the broad tape of the D-1000, it is arrayed in 31 channels of two electronic "words" per channel, yielding a total of 62 "words" to form what is known as a block. The sequence of digits or characters is arrayed longitudinally along each channel. Thus channel #1 may contain in its two words the information: "JAMES C. WILSON." Channel #2 in its two words might contain "187 PARK AVENUE," etc. Each word contains 48 binary digits of information, which is to say a representation of the information by a sequence of "1's" and "0's," more commonly understood if thought of in terms of dots and dashes. Generally, each alphabetic character is represented by a unique and distinctive array of six binary digits called bits. Also, every numeric digit

RICHARD M. BLOCH, inventor of Orthotronic Control, is director of product development at the DATAmatic division of Minneapolis-Honeywell. He directed the development of the Datamatic 1000, and holds key patents governing automatic checking of digital data-handling, patents widely used throughout the industry. Formerly he was manager of Raytheon Manufacturing Company's Computer Division and his work there included development and production of Raydac. He holds a staff position at Harvard University Computation Laboratory, and formerly headed operation and programming for Mark I digital computer at Harvard, where he won degrees with honors in mathematics and physics. He is a member of the Consultants' Section, Radio Division, Naval Research Laboratory; the American Association for the Advancement of Science; the Association of Computing Machinery. He is the author of numerous papers on design of data-handling equipment and the recipient of several achievement awards from various universities.



Circuitry of a single chassis of the high speed converter of a DATAMATIC 1000 is checked by one of the company's highly trained specialists. It is the converter which translates the electronic language of the machine's magnetic tapes into the everyday English and Arabic numerals of its final printed product. It translates onto punched cards at a rate of 6,000 per hour and turns out reports or records at 900 lines per minute. Into circuitry of this type will be channeled the electronic impulses of Orthotronic Control.

can be represented by a sequence of four successive binary digits. One might have then as many as eight alphabetic characters in a "word" of 48 bits, or, alternatively, 12 decimal digits in a "word." Each "word" contains four additional bits known as a "weight count," which, in practice are electronic codes used as checking references. This "count" has certain peculiar properties which make it capable of monitoring the accuracy of information to which it is affixed. This is a fundamental part of the checking system of the Datamatic 1000 system. Whenever a word is transferred from one location to another location, the machine automatically reviews the information content (i.e., the 48 bits) of the word and generates the "weight count." If this generated quantity is in agreement with the "weight count" which had been transmitted with the word itself, it is then known that no error of ommission or commission had occurred and that the information content of the word continues to be correct.

correction monitor channel

Orthotronic Control as applied to the Datamatic 1000 utilizes on the magnetic tape an additional channel—the 32nd—called the Correction Monitor Channel (C.M.C.). The information which is contained within the C.M.C. is devised as follows: Information bit No. 1 of "word" No. 1 sits in the upper left hand corner of the block of the information being recorded on the tape. Just below this bit will be information bit No. 1 or word No. 3; below this will be bit No. 1 of word No. 5, etc. Bit No. 1 of the C.M.C. will be constructed by the following method: if there is an odd number of ones in the information posi-

tion No. 1 of words 1,3,5 . . . 61, then bit number one of the C.M.C. shall be a "1". However, if there is an even number of ones in those information positions, the first information bit of the C.M.C. shall be an "0". This process of construction is repeated for all information bits of the odd-numbered "words," including the "weight count" positions of these words. This produces the first 52 bits of the C.M.C. Furthermore, this process is repeated for the even-numbered "words" in the very same fashion to produce a second set of 52 bits for the Correction Monitor Channel; this gives a total of 104 bits in the C.M.C.

It might be well at this point to state where this process takes place. Information which is intended to be written in the Datamatic 1000 comes forth from the memory section of the machine and is transmitted to what is called the output buffer section, then the process which has been described above proceeds automatically by means of appropriate circuitry for the purpose. In this way, by the time all 62 "words" that are to be written as a block of information on the tape have been collected in the output buffer, the two "words" of the C.M.C. channel have also been constructed and are ready for the actual recording operation. When the appropriate instruction comes forth from the control unit of the system for the recording of the block of information, 32 channels of information are recorded simultaneously—31 channels of information and the Correction Monitor Channel. This then completes the first part of the Orthotronic Control operation.

At some later time—it may be 20 minutes, several hours, or several days—it is desired to read the information on this tape back into the Central Processor. It is at this point that the actual correction process to be described takes place. When the instruction is given via the control unit to read the tape, all 32 channels are read simultaneously into the input buffer section of the system. Up to this point, please note, there is no knowledge whatsoever as to the authenticity of this information.

The next step in the normal processing procedure is to call for the transmission, word by word, of this information in the input buffer into the main memory section of the machine. It is at this point that information is verified for accuracy by applying the normal "weight count" procedure. If the information content (the first 48 bits) of a "word" doesn't agree with its "weight count," it is known that this "word" has certain inaccuracies within the body of its information. Previously when this was determined, certain alternatives were open to the programmer. He could ask the machine to stop or could attempt to reread the information in the hope that upon the second reading the information would be found to be correct.

With Orthotronic Control, however, a different and completely constructive action is taken. When a word is found to be inconsistent with its transfer count, a note is made of this by the machine and the remaining words of the block continue to be read into the memory from the input buffer. After all 62 words have been entered into the main memory, a new set of two correction monitor words is produced by the machine. This is accomplished, in this instance, by means of special instructions which are being added to the Datamatic 1000 to enable this monitor to be manufactured.

the s.c.m.c

We call this new correction monitor channel the Secondary Correction Monitor Channel. The S.C.M.C. is constructed just as described with reference to the C.M.C. The machine now automatically compares the C.M.C. with the S.C.M.C. and notes those bit positions in which the two quantities differ. With this knowledge and with the knowledge of the channel which has been in error (this having been obtained when the "weight counts" were monitored in the passage from the input buffer to the memory), the Datamatic 1000 will proceed with a rectification process of the erroneous information contained within said channel.

This rectification process is as follows: In each bit position wherein the C.M.C. and the S.C.M.C. differ, (i.e., a "1" vs. an "0" or an "0" vs. a "1"), the machine will invert the corresponding binary digit in the channel at fault. On the other hand, however, for each bit position in which the C.M.C. and the S.C.M.C. are identical, the Datamatic 1000 will leave that corresponding bit position in the questionable channel undisturbed. It is to be noted that this process holds true of all 104 bits of the channel which is being rectified, including the weight count positions.

The result of this rectification process will be the reconstruction of the erroneous channel into its original authentic form. Thus, for example, in the illustration given earlier, let it be supposed that when Mr. Wilson's record was read into the Datamatic 1000, it was received erroneously at the main memory of the system, as follows: "JAMES C. WILSON" (in channel No. 1) "389 CORK AVENUE", (in channel #2) with the remainder of the information in this item all correct. At the completion of the Orthotronic Control process just described, precisely the correct address, namely "187 PARK AVENUE," will have been reconstructed. This was reconstructed, it is to be noted, despite the fact that the street address was completely erroneous. It is further to be noted that had the information come into the central machine erroneously as "JUMBED OULBERSON" (in channel one) "187 PARK AVENUE" (in channel two) with the remainder of the record being correct, the Orthotronic Control system will correct the entire name of this individual to its authentic original form; namely, "JAMES C. WILSON." What is being stressed here, then, is that any channel within a block of information, no matter how badly garbled it is, can be brought back into its correct form as a result of the OC system.

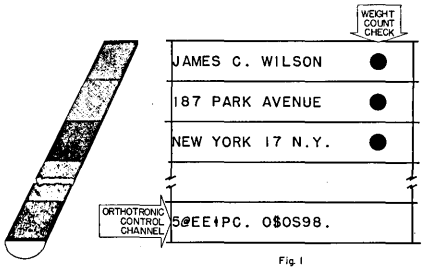


Fig. 1

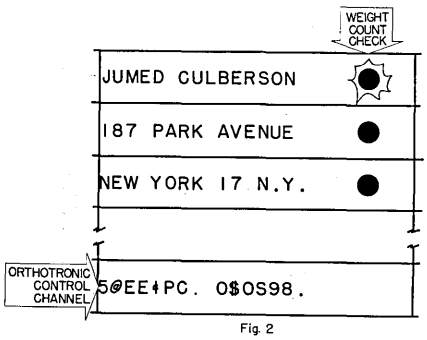


Fig. 2

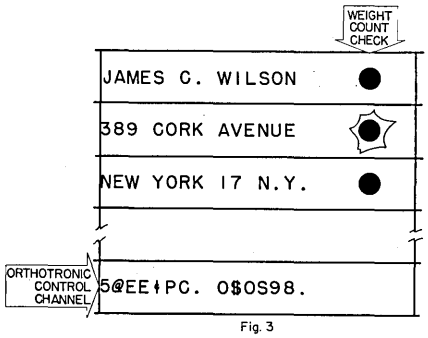


Fig. 3

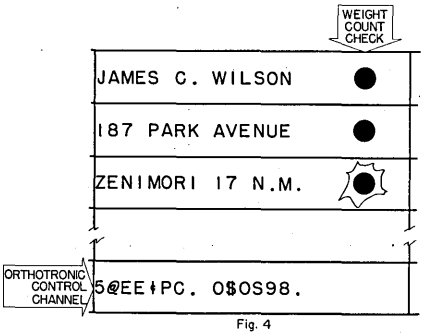


Fig. 4

The attached diagrams illustrate the power of Orthotronic Control to correct or restore recorded information that has become garbled or lost within the data processing system.

Figure 1 illustrates a correct name and address as it would be recorded on DATAmatic magnetic recording tape.

Figure 2 shows that the data processing system having read this information has detected an error in the name. At this point, the system knows only that an error has occurred and that it has occurred in the channel containing the name. It now, however, turns to the information in the Orthotronic Control channel and from this information it is able to reconstruct the original name in its correct form.

Figure 3 illustrates a similar situation with respect to the street address. Here again the error is detected by the weight count check and the specific corrections are made according to the information supplied in the Orthotronic Control channel.

Figure 4 provides still another example, this time an error occurring in the city and state channel. As in the previous instances, the error is immediately detected and corrected. *In fact, any error, regardless of type, cause or extent, in any information channel can be resurrected as a result of Orthotronic Control.*

Now, once a correction has been made, the machine will proceed with the processing as it would have done normally. No human intervention has been required, and, indeed, the operator might well have been completely unaware that the correction had taken place (had he not received a typed note as mentioned above.)

A feature of this system is the fact that the autocorrection process is brought into play only when an inconsistency is noted in the "weight count" of any of the words; no useless work is performed by the machine when the information is known to be correct.

The same Orthotronic Control system is applied to all tapes being written by the machine, including those which are recorded by the input converter (card-to-tape converter) of the system. In this instance, the Correction Monitor Channel is constructed much in the same way as was done in the output buffer section of the central machine and when the card information is recorded upon the tape, the Correction Monitor Channel is laid down simultaneously. Later, of course, when this tape is read by the central machine, Orthotronic Control comes into play in the same way as has been described above.

Circle 102 on Reader Service Card.

DATAMATION *book capsules*

BASICS OF DIGITAL COMPUTERS, John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N. Y., three volumes, $6.95 the set.

"First digital computer books for the average man with a basic knowledge of electronics," is the publisher's claim with this three-volume "picture book" course toward the understanding and mastery of the fundamental principles of digital computers.

The first volume begins with development of computers from the times of ancient peoples and goes on to furnish a background in digital computers, explaining binary data representation, computer arithmetic, programming and control. Second volume introduces the building blocks of logical systems. At this point the reader makes the transition from thinking in terms of communications to "computer thinking". Volume three deals in detail with the major logical systems in a digital computer and explains the processes of storing and transferring data within the computer.

OFFICE AUTOMATION Handbook by R. Hunt Brown, Automation Consultants, Inc., 155 Fifth Avenue, New York 10, N. Y., 500 pp., 300 illus., $37.50, (monthly updating service $37.50 per year, optional.)

This publication describes and illustrates, by means of pictures, charts, virtually every practical automated office machine and system, say the publishers. Typical equipment reviewed — electronic computers, common language machines, native language machines, memory systems, printers of practically all manufacturers in the computer and data processing field.

Some recommendations: "of value to businessmen contemplating purchase of a computer", "handy manual for the layman" . . . "of interest to systems personnel making feasibility studies." This handbook is compiled in loose-leaf form to allow for revisions and additional information provided by the monthly updating supplements.

LINEAR PROGRAMMING: FUNDAMENTALS AND APPLICATIONS, by Robert O. Ferguson and Lauren F. Sargent, 1958, H. B. Maynard and Company, Inc., Pittsburgh, Penna., 360 pp., 337 illus., McGraw-Hill, $10.00.

Linear programming, a significant tool of scientific management, is treated by authors Sargent and Ferguson. Presenting the where, why and how of the subject and illustrated by actual examples from industry, the book is directed to executives and managers at all company levels with a view to application of this information to their own problems in industry.

Divided into four independent sections . . . Introduction, Methods, Application, and Technical Appendix . . . the book includes two new computational methods and a time-saving refinement (called MODI) of an existing computational method, developed by the authors.

THE PROCEEDINGS OF THE "SYMPOSIUM ON NEW COMPUTERS", 1957, Association for Computing Machinery, 2 E. 63rd St., New York 21, N.Y., 132 pp. $2.50.

Contains the papers presented at the symposium together with comments made during the question and answer period. Typical of the contents:Magnetic Tape File Processing With The NCR 304, A New Large-Scale Data Handling System DATAMATIC 1000, Design Objectives for the IBM Stretch Computer. The papers delivered by leading men from the respective computer organizations.

Since the discussions were of the newest equipment, much of which is currently being delivered, readers will find material interesting and timely, say the publishers.

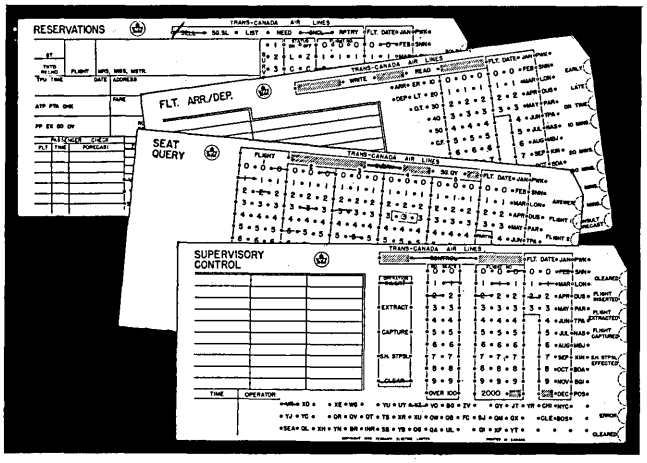
COST CONTROL THROUGH ELECTRONIC DATA PROCESSING by Phil Carroll, 1958, Society for Advancement of Management, 74 Fifth Avenue, New York 11, N. Y., 32 pp., $1.50.

This booklet sets forth ground-rules of question-asking (programming) and corrective managerial action in the use of electronic data processing as a cost-control instrument, on the basis that unless management knows "the right questions to ask," modern electronic data processing may multiply rather than reduce the costs of a business.

"I guess the electronic brain must give the right answers . . . Both the boss and the bargaining committee don't want any part of it in settling the wage issue."

FERRANTI TRANSACTOR

trans canada air lines operations streamlined



Trans Canada Air Lines now has in operation a new transactor developed by Ferranti Electric of Toronto for both their reservation system and also for the provision of statistical data for future planning. The Ferranti device, known as the business transactor, appears to be suitable for stock control, mail orders, freight services and many other general applications.

The transactor represents Ferranti's solution to the very common problem of providing on demand adequate manual input/output facilities to a modern high speed conversion data processing system. The presently used forms of input, such as magnetic tape, punched cards or punched paper tape, do not readily adapt themselves to use where the conversion is to form an integral part of an overall system. The transactor allows the system to accept a manual input and also provides an answer which is more complex than a simple yes/no.

In the reservation application, the unit indicates the number of seats available and other items of value to the booking agent about particular flights.

In all computers, arithmetic operations are performed at very high speed and this speed is becoming greater as development proceeds. It is, however, still necessary both to feed the problem to the machine and to extract the answer from it in a usable form. These input and output stages are probably the least advanced of the techniques and can represent a considerable handicap to the overall computer speed. Various forms of input are used including magnetic tape, punched cards, and punched paper tape and the reading rates for all these systems can be as high as many hundred pieces of information per second. For output information a teleprinter is normally used in England and for this application various forms of high speed printing devices have been developed to produce page copy at very high rates.

In some applications, however, where the machine is being used as a filing and reference system rather than as a calculator, the input and output facilities can be much simpler. In such cases the computer may be asked to refer to a single location in its store and give a simple yes or no answer depending on certain conditions or alternately to perform some operation at this location and to acknowledge that this has been carried out. There are a number of applications where such a use is all that is demanded of the computer; for instance the stock control in a large organization, the mail order business where stock information is required very quickly by an order clerk, and a reservation system for passenger cr freight service.

The Ferranti Business Transactor was developed for Trans Canada Air Lines by Ferranti Electric Limited of Toronto to fulfill their requirement for a reservation system which would not only meet their present needs but also be sufficiently flexible to be adapted to other comparable uses within the airline. The system had to be capable of expan-

sion to meet the increasing needs of the airline and to provide statistical data for future planning.

In essence the system was required to accept a manual input and to provide an answer which could be more complex than the simple yes/no. It had, for instance, to indicate the number of seats available and many other items about particular flights of value to the booking agent.

The system can be divided conveniently into sections. The main and largest part is, of course, the computer which has stored in it information for all flights for a period of one week ahead; connecting to this by means of telephone lines are various local distributors to which are connected the Transectors enabling the agent to make his reservation or inquiry.

the reading system

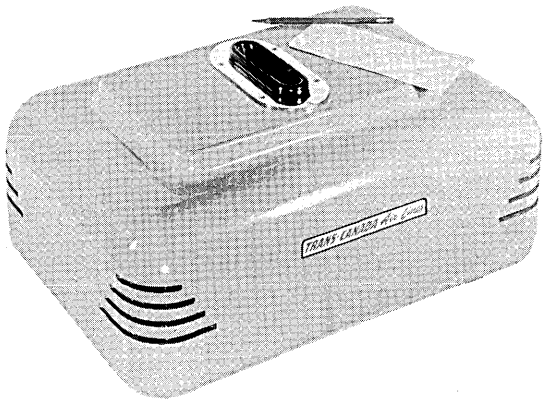
The transactor "reads" statically, pencil marks made on a reservation card. These pencil marks must be in one or more of 285 positions (in the present machine), and small circles are printed on the card which the user joins with his pencil mark to indicate some particular information. When inserted into the transactor, the card is clamped, by a solenoid operated platen, against a bank of "reading" electrodes. Each of the 285 electrode groups consists of three silver paladium wires so situated that a pencil mark made between the printed circles on the card will lie across the wires when the card is clamped. The three wires are equally spaced and the outer ones are common to each other and also to the outer wires of all other electrode groups. The center wires are brought out individually and wired to a selector switch. A voltage is applied to all the common wires and the "reading" of a mark is accomplished by measuring the current flow between the common electrodes and the mark position electrode being read. Since the card is in contact with all the electrodes, all marks are read simultaneously.

The 285 positions are then scanned by a stepping switch which itself has 12 banks. The information leaves the transactor, therefore, in twenty-five "words" each having a maximum of 12 bits. These words are treated further in the distributor to produce a completely serial message for transmission on a telephone line.

The pencil marks indicate in most cases a resistance varying between 50,000 and 100,000 ohms, but the circuits at present being used will recognize a mark having a resistance as high as one megohm. The resistance of an unmarked card at the voltages used is at least 10 megohms even under very humid conditions. The current output will vary from approximately 150 microamps to over a milliamp assuming a short circuit in the reading circuit. Any load added would naturally reduce the current by the appropriate amount.

The scanning action is completed by the stepping switch in its self-cycling condition and the whole card is read in approximately 0.5 seconds. The switch stops at its home position waiting for a further scanning signal which will be given only when a fresh card is inserted and the computer is ready.

The insertion of a card which has not been notched in either of the two outside positions actuates, by means of small levers, two microswitches. One of these two switches is used as a signal to the computer and forms part of the information transferred; the second switch controls the clamping mechanism. In cases, therefore, in which the second notch has already been punched, no further action can be taken since the card will never clamp. This feature is useful in enabling a control to be exercised over used cards preventing the repetition of an operation which has already been performed. In general, therefore, two reply positions are sensed and used for information and



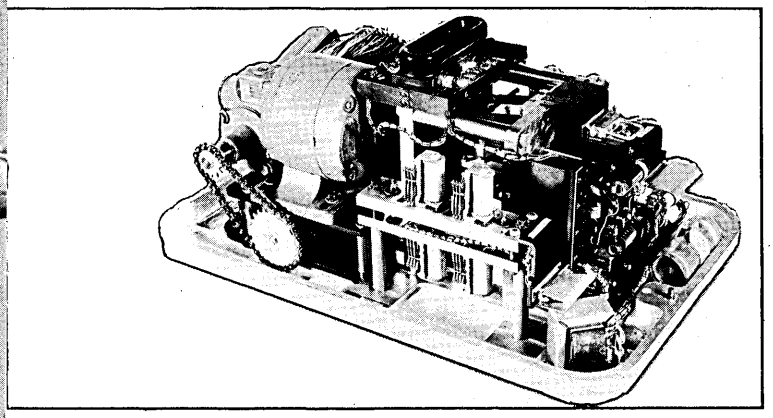
control. It would be possible to use both positions for information only but in this case some additional clamping control would need to be provided. A further switch at the top of the unit indicates that a card has entered. The switching is so arranged that the sequence—top switch followed by bottom sensing switch—must be observed before the card is clamped. This ensures that a card is removed completely before operation is started.

The clamping mechanism comprises a stainless steel platen which is moved by a solenoid under the action of a double toggle linkage. The use of this linkage results in a total force of approximately 200 lbs. being applied to the platen with a motion which has a very smooth action and a rapidly decreasing rate of travel as it approaches its final position. This results in a squeezing action of the card against the reading electrodes and in this way avoids damage, particularly to the electrodes themselves. The solenoid is dc. operated and is pulsed from a condenser initially to ensure that adequate force is available when the armature is at the extreme limit of its travel. The rectifiers (silicon) and condenser are included within the unit.

the reply system

The reply to the machine will cause up to nine punches to operate, cutting small notches in the bottom of the card. The punches are spring driven and released as required by a solenoid trigger mechanism. The nine trigger solenoids are connected to nine of the twelve signal wires after the

card has been scanned and a punch is made to operate by connecting the appropriate lead to ground. The completion of the punching operation starts a motor within the unit which recocks any of the punches which have been used. The final shaft driven by the motor makes one revolution only and punches can, if necessary, be operated again within one second. The punch springs have a final compression of approximately 15 lbs. for each punch and this allows a very considerable margin to enable punching to continue even after the punch edge becomes blunt. The trigger mechanism uses a hardened steel ball in conjunction with a notched plunger. This type of mechanism gives very positive latching and requires a low trigger force. The solenoids used in the trigger action are very



small and have a large margin available to increase reliability. A pushbutton is incorporated underneath the unit to cock the punches when a machine is first put into service or after repair since it is advisable to store a machine with the punches in the released position.

circuitry within the unit

The Transactor contains eight relays mounted in two groups of four on plug in detachable chassis. These relays perform the necessary logical functions to control the operation. Most of the functions have already been mentioned but they will be enumerated here for the sake of completeness.

1. Control of top and bottom switch logic to prevent operation of the machine without removing completely the card in use.
2. Indication to the distributor that a card is ready for scanning and initiates scanning when the computer is ready.
3. Control of the indicating lights. A green light is normally on and this is extinguished while a card is being processed. At the completion of the operation when the card is free to be withdrawn, either a green or red light is illuminated. The green indicates normal operation while the red appears if a failure has occurred in the parity check between the computer and the distributor.
4. Control of the switching of the signal lines from output to input after scanning.
5. Control the cocking of the punches after a reply and the release of the card.

general construction

The unit is mounted on a cast aluminum base with a cast cover of the same material. A multicore cable is brought out from the underside and terminates in a plug. Four rubber feet allow sufficient space for the cable to be routed to any side. The mouthpiece, situated centrally on the top of the unit, is fitted with edge lighted pieces of plastic to give the green and red indicating lights. The Transactor can be mounted on top of a table or can be supported underneath, allowing only the mouthpiece to protrude. The unit has no operating controls.

The overall dimensions are 20½ in. x 13½ in. x 8⅝ in. high and the weight is approximately 100 lbs. The overall power requirements are as follows:

115 Volts	60 Cycle	Single Phase—300 VA
48 Volts	D.C.	1.5 Amps
300 Volts	D.C.	60 m/a max.

The present equipment handles four different types of card. It will be seen that where retention of data is required for subsequent ticketing the card contains all the necessary information and is, in fact, used as the record.

The system is so arranged that the first information fed in the computer is the instruction line and from this the machine can determine what significance to give to any particular mark. This is most necessary since even from these few card examples marks in similar physical positions do not mean the same on different cards. This feature is most valuable in assuring the flexibility of the system so that it is in no way limited to a particular card layout but is controlled simply by the initial instruction and the programme which is inserted in the computer itself. A complete system would entail one central computer in which all information is stored and to this would be connected by trunk and branch lines all the Transactors in the system. Once such a system was in operation no limit would exist to the possibility of adding other types of information to the computer which would be available to any transactor. It is an indication of flexibility of the system that the Transactor itself can also be used to insert information as well as to use it.

An indication of the ease with which the machine can be used is shown by the short training period necessary. Instruction for one hour on the four different card types was adequate recently for booking agents to be able to use the machine during subsequent operation with every confidence and without making any errors.

A further interesting aspect of such a system is that the computer will print or produce on punched cards a complete record not only of reservations or wait listings which have been made, but also the details of reservations which it has failed to make. The value of this statistical information for planning purposes cannot be overestimated.

Circle 103 on Reader Service Card.

I-A CONFERENCE COMPUTER CLINIC

"Instrumentation in the Space Age" will be the theme of the 13th Annual Instrument – Automation Conference and Exhibit to be held September 15 - 19, in Convention Hall, Philadelphia. The gathering, sponsored by the Instrument Society of America, is expected to draw about 30,000 engineers, scientists and management personnel from all over the world. Latest instrument developments in virtually every field will be on display.

An important part of the conference will be the 1958 Computer Clinic, on September 16. Computers for application to all industries will be discussed by experts and they will examine in detail specific application in many of the key industries served by the Instrument Society of America.

The clinic will be conducted at two levels. Computer instrumentation scientists will instruct otherwise accomplished engineers in a better understanding of the performance of analog and digital computers as tools of the instrumentation field. In two parallel afternoon sessions, particular applications of analog and digital computers will be covered.

Papers presented at the opening session will cover the basic techniques of both analog and digital computers, components of analog computers – amplifiers, input-output devices, recording and readout – and the components of digital computers, such as drums, cores, registers, arithmetic units and input-output. A specialist from International Business Machines Corporation will conclude the morning session with his paper on components of digital computers.

Particularly timely to the theme of this year's conference will be a discussion of real-time airborne computer used in missiles and aircraft. The general concept of the process control by digital computer will be described. In the concurrent session on analog computers, papers will cover the various problems on the use of these units in the chemical, nuclear, power and aircraft industries.

DATAMATION *on campus*

MIT HAS CENTER FOR COMMUNICATION SCIENCES

A Center for Communication Sciences at the Massachusetts Institute of Technology has been established and is now functioning. Studies of the communication operations of the nervous system and of such machines as computers, as well as methods of communication between the two, are being conducted by a group of scientists and engineers, some of whom have been engaged in such research for several years. The center (using Research Laboratory of Electronics facilities) is under the direction of a steering committee composed of Dr. Jerome E. Wiesner, RLE director; Dr. Claude E. Shannon, Dr. Gordon S. Brown, Dr. Robert M. Fano, Dr. Roman Jakobson and Dr. Walter A. Rosenblith. Commenting on their program, Dr. Wiesner said, "We build computers which analyze data faster than we can use the answers. Man can't think rapidly enough to keep up with them. On the other hand, computers are not sufficiently flexible to be as useful as they could be . . . We believe that collaborative work between mathematicians, electrical engineers, linguists, psychologists, physiologists, and others should lead to a new understanding of communications and to a more effective use of machines.

EDP EVALUATION SLATED BY AMERICAN UNIV.

Evaluation of current developments and experience reports in automatic data processing will be featured at American University's Fifth Institute on Electronics in Management to be held November 3 to 7 in Washington, D. C. The institute is planned for management officials of business and government to provide a basis for evaluating their current problems in EDP. Lectures, discussion periods, workshop sessions, films and case reports will be featured. Registration and program details are available from Lowell H. Hattery, director of the Institute on Electronics in Management, American University, 1901 F St., N. W., Washington 6, D. C.

FUND SET UP FOR DATA PROCESSING BOOKS

A $4,150 endowment fund for the purchase of books in the field of data processing has been established at UCLA by the National Machine Accountants Association, in memory of Bruno Chiappinelli. He was an Association member and UCLA grad. The check was presented in a brief ceremony at the university by NMAA representatives Ralph Singman, Eugene Sheehan and George Taylor. Accepting for UCLA were Dr. Neil H. Jacoby, Dr. George Brown and Gordon Williams.

U. OF CHICAGO HAS PLANS FOR UNIVAC

The University of Chicago has announced plans for its Univac computer that include detailed analyses of the nation's population, weather and economy. The $1,391,600 gift of Remington Rand is being considered for processing of the 1960 census statistics to study population trends, IGY data to determine the functions of the jet stream, and both census and current business figures to develop theories of the U. S. economy.

WESCON EDP OFFERINGS LISTED

pertinent papers selected from 42-session schedule

Among the presentations to be delivered at the Western Electronic Show and Convention's 42 technical sessions are many which will be of great interest to DATAMATION readers. Far from being presented at any one place or time, they are scattered through sessions to be held on August 19, 20, 21 and 22 at Pan Pacific Auditorium in Los Angeles. For the convenience of those wishing to attend as many of these sessions as possible, the following list has been prepared.

Session 1 *Tuesday, August 19, 9:30 a.m.—noon, Embassy Room COMPUTER APPLICATIONS*
"Data Preparation for Numerical Control of Machine Tools" by H. D. Huskey and Donald E. Trumbo, Bendix Aviation Corp.
"A Library of Blip Samples for Use in the Realistic Simulation and Evaluation of Automatic Radar Data Processing Systems" by Charlton M. Walter and Helen M. Willett, Air Force Cambridge Research Center.
"GCA by Automatic-Voice Data Link" by John J. Fling and M. H. Nothman, Gilfillan.
"A Computer Simulation Chain for Research on Picture Coding" by R. E. Graham and J. L. Kelly, Jr., Bell Telephone Labs.

Session 3 *Tuesday, August 19, 9:30 a.m.—noon, Boulevard Room TELEMETRY*
"Theoretical Data Acquisition Analysis and Practical Appraisal of Existing Airborne Systems" by B. M. Gordon and R. D. Jorup, Epsco, Inc.
"High Acceleration Telemetering" by T. D. Horning, Bendix Aviation Corp.

Session 4 *Tuesday, August 19, 9:30 a.m.—noon, Ambassador Ballroom INFORMATION THEORY*
"Optimum Linear Estimation as the Limit of Sampled Data Estimates" by Peter Swerling, Rand Corporation.
"Statistical Invariance of Noise in Sampled-Data Systems" by S. A. Zadoff, Sperry Gyroscope Co.

Session 6 *Tuesday, August 19, 2:00—4:30 p.m., Embassy Room COMPUTER DEVICES*
"Achieving Maximum Pulse Packing Densities and Transfer Rates" by Boyd W. Thompson, Ampex Corp.
"An Emitter Follower Coupled High Speed Binary Counter," I. Horn, Burroughs Corp.
"Coincident Current Applications of Ferrite Apertured Plates" by W. G. Rumble and C. S. Warren, R.C.A.
"Information Storage for Microspace" by Sterling P. Newberry, General Electric Co.

Session 8 *Tuesday, August 19, 2:00—4:30 p.m., Boulevard Room AIRBORNE ELECTRONIC DEVICES*
"A Precision Digital Data Acquisition System for Instrumentation Radars" by Robert Snyder, Electronic Engineering Co.
"Digital Computer System for Terminal Area Air Traffic Control" by E. L. Braun and A. S. Gianoplus, Litton Industries.

Session 9 *Tuesday, August 19, 2:00 to 4:30 p.m., Ballroom CIRCUIT ANALYSIS AND DESIGN*
"Predistorted Filter Design with a Digital Computer" by Philip R. Geffe, Audio Development Co.

Session 10 *Tuesday, August 19, 2:00—4:30 p.m., Venetian Room MICROWAVE THEORY AND TECHNIQUES II*
"On the Solution of Some Microwave Problems by an Analog Computer" by Donald M. Byck, EAI Computation Center, and Allen Norris, Varian Associates.

Session 13 *Wednesday, August 20, 9:30 a.m.—noon, Boulevard Room INSTRUMENT TOOLS*
"Operational Feedback and Data Processing Amplifiers" by Sverre Sem-Sandberg, Consolidated Electrodynamics.

Session 15 *Wednesday, August 20, 9:30 a.m.—noon, Venetian Room AUDIO*
"Experiments with Speech Using Digital Computer Simulation" by E. E. David, M. V. Mathews and H. S. McDonald, Bell Tel. Labs.

Session 18 *Wednesday, August 20, 2:00—4:30 p.m., Boulevard Room AUTOMATIC CONTROL*
"Some Simplifying Additions to Basic Sampled-Data Theory" by C. O. Carlson, U.C.L.A.
"Enhanced Real Time Data Accuracy for Instrumentation Radars by Use of Digital Hydraulic Servos" by R. P. Cheetham and W. A. Mulle, R.C.A.

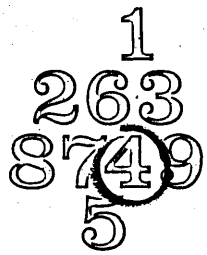
Session 19 *Wednesday, August 20, 2:00—4:30 p.m., Ballroom INSTRUMENT SYSTEMS*
"An Airborne Digital Tape Recorder," S. Cohen and A. T. Arcand, General Precision Lab.

Session 23 *Thursday, August 21, 9:30 a.m.—noon, Embassy Room ANALOG COMPUTERS*
"Anticipatory Display Design Through the Use of an Analog Computer" by Lawrence J. Fogel, and Milton Dwonczyk, Convair.
"An Analog Memory" by W. S. Kozak, Canadian Westinghouse Co.
"Network Solution of the Right Triangle Problem" by M. R. Winkler, Goodyear Aircraft.

Session 25 *Thursday, August 21, 9:30 a.m.—noon, Boulevard Room MILITARY ELECTRONICS*
"Talos Land Based System Digital Checkout Equipment" by Francis X. Beck, R.C.A.

Session 29 *Thursday, August 21, 2:00—4:30 p.m., Sunset Room HUMAN FACTORS IN ENGINEERING*
"Simulation of a Human Tracking Problem on the UDEC III Computer" by H. Platzer, Burroughs Corp.

Session 33 *Friday, August 22, 9:30 a.m.—noon, Embassy Room SOLID STATE I*
"Millimicrosecond Diffused Silicon Computer Diodes" by J. H. Forster and P. Zuk, Bell Telephone Labs.



Important dates in DATAMATION

August 19-22: Western Electronic Show and Convention, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles. Sponsored by IRE and WCEMA. Contact Don Larson, 1435 S. La Cienega Blvd., Los Angeles 35, Calif.

August 25-28: 39th Summer Meeting of The Mathematical Association of America, Cambridge, Mass.

August 25-30: American Mathematical Society holds their 63rd Summer Meeting, Cambridge, Mass.

Sept. 1-7: International Association for Analog Computation — Second International Conference, University Palace, Strasbourg, France.

Sept. 10-12: SHARE Meeting, San Francisco, Calif.

Sept. 15-17: Power Industry Computer Application Conference, King Edward Sheraton Hotel, Toronto, Ontario, Canada. Sponsored by the AIEE. Contact Dr. J. Ham, Electrical Engineering Department, University of Toronto, Toronto, Ontario, Canada.

Sept.15-19: Thirteenth Annual Instrument-Automation Conference and Exhibit (International), Philadelphia Convention Hall, Philadelphia, Penna. Sponsored by ISA. Contact J. F. Tabery, 3443 S. Hill St., Los Angeles 7, Calif.

Sept. 22-24: National Symposium on Telemetering, Americana Hotel, Miami Beach, Fla. Sponsored by the PGTRC. Contact Ken West, 1345 Indian River Dr., Eau Gallie, Florida.

Oct. 6-7: Symposium on Extended Range and Space Communications, Lisner Auditorium, George Washington University, Washington, D.C. Sponsored by IRE and the George Washington University. Contact Harry Fine, Federal Communications Commission, Washington 25, D.C.

Oct. 13-15: International Systems Meeting, Systems and Procedures Association, Hotel Penn-Sheraton, Pittsburgh, Penna. Contact A. M. Motter, Jones and Laughlin Steel Corp., #3 Gateway Center, Pittsburgh 30, Penna.

Oct. 20-21: Remington Rand Univac Users Conference, John Hancock Mutual Life Insurance Company, Boston, Mass. Contact R. M. Petersen, Secretary, Univac Users Conference, General Electric Company, Appliance Park, AP 1-109, Louisville, Kentucky.

Oct. 20-24: National Business Show, Coliseum, N.Y.C. Contact Rudolph Lang, Managing Director, 530 5th Ave., New York 36, N.Y.

Oct. 22-25: The National Businessmen's Exposition, Great Western Exhibit Center, Los Angeles, Calif. Sponsored by NMA. Contact Robert W. Caldwell, NMA Show Chairman, National Businessmen's Exposition, 2807 Sunset Boulevard, Los Angeles 26, Calif.

Oct. 23-25: The National Society of Professional Engineers—fall meeting, St. Francis Hotel, San Francisco, Calif. Contact Kenneth E. Trombley, National Society of Professional Engineers, 2029 K St., N.W., Washington 6, D.C.

Oct. 23-25: 1958 National Simulation Conference, Statler-Hilton Hotel, Dallas, Texas. Sponsored by IRE-PGEC. Contact J. E. Howard, 2100 Menefee Dr., Arlington, Tex.

Oct. 25: American Mathematical Society Meeting, Princeton University, Princeton, New Jersey.

Oct. 27-28: Fifth Annual East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore. Sponsored by IRE. Contact Harry Rutstein, Publicity Chairman, Lord Baltimore Hotel, Baltimore, Maryland.

Oct. 29-30: Fifth Annual Computer Applications Symposium, Morrison Hotel, Chicago. Sponsored by the Armour Research Foundation, Illinois Institute of Technology. Contact the Foundation at 35 W. 33rd St., Technology Center, Chicago 16, Ill.

Oct. 30-31: Fourth Electronic Business Systems Conference, Olympic Hotel, Seattle. Sponsored by the western division of the NMAA. Contact E. B. S. Conference, NMAA, P.O. Box 134, Seattle 11, Washington.

Nov. 16-21: International Conference on Scientific Information, Mayflower Hotel, Washington, D.C. Sponsored by NAS, NRC, NSF and ADI. Contact Secretariat, International Conference on Scientific Information, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington 25, D.C.

Nov. 17-18: Federal Govt. Accountants Association's 8th Annual Symposium. Theme: "Management and Electronic Data Processing." Contact Martin C. Powers, 1523 L St., N.W., Washington 5, D.C.

Nov. 17-20: Fourth Annual Conference on Magnetism and Magnetic Materials, Sheraton Hotel, Philadelphia, Penna. Sponsored by AIEE. Contact John Leslie Whitlock Associates, Exhibition Managers, 6044 Ninth St. North, Arlington 5, Virginia.

Nov. 19-20: Northeast Electronics Research and Engineering Meeting, Mechanics Hall, Boston, Mass. Sponsored by IRE. Contact J. J. Faran, General Radio Company, 22 Baker Avenue, West Concord, Mass.

Nov. 20-21: American Mathematical Society Meetings; Pomona, Calif.; and Nov. 28-29: Northwestern University, Evanston, Illinois, and Durham, North Carolina.

Dec. 3-5: Eastern Joint Computer Conference, Bellevue-Stratford Hotel, Philadelphia, Penna. Contact John M. Broomal, Burroughs Corp., Paoli, Penna. (publicity information) or Dr. F. M. Verzuh, MIT Computation Center, Cambridge 39, Mass. (program information).

Jan. 20-22, 1959: American Mathematical Society—65th Annual Meeting, U. of Pennsylvania, Philadelphia, Pa.

June 15-20, 1959: International Conference on Information Processing, Paris, France.

DATAMATION DOWN UNDER

an aussie comments on the industry

(Well known in this country and in Europe as well as in his native Australia as a leading authority in the data processing field, DR. JOHN M. BENNETT is associated with the Adolph Basser Computing Laboratory at the University of Sydney. Following are excerpts from his address at a Controllership Conference in Katoomba.)

One element which is frequently encountered in the purchase of computers is a phenomenon well known to salesmen of expensive products of various types – which has become known as the "penguin" phenomenon. The metophor is derived from the supposed behaviour of penguins sitting on an iceberg. They look at each other and look at the sea and look at each other again. After a time one of them, a little more venturesome than the others, or perhaps after being given a push, goes in. The others shake their heads and await the worst. However, after a period, the immersed penguin surfaces and says: "Come in boys, it's fine in here." The others follow promptly . . .

Many organizations approach the possibility of using a large scale data processing installation by trying to justify the expenditure purely on the basis of clerical procedures currently handled by semi-automatic punched card devices. Gains resulting from additional flexibility are ignored – gains such as the ability to handle exceptions without re-runs, the ability to obtain a variety of reports as a by-product of a data processing run, and the reduction of time delays in furnishing management with essential information. A case resting on this basis alone can usually be made; however, there have been instances in which a too optimistic preliminary study has led management to expect gains over previous techniques which have not been realized in the event. I mention this primarily as a warning against the inadequate initial study; such a study will inevitably err on the side of optimism. . .

The question of commercial security is likely to arise with organizations which have been using the services of a service bureau for processing of accounting calculations. There is a feeling among accountants that the desirability of farming out work is low, primarily on the grounds of security. Although it is doubtful whether such an attitude is justified, it is nevertheless a very real one, and it is certainly very true that the additional convenience afforded by having one's own equipment on call as desired, is worth quite a lot. The problem is similar to that of the farmer who has to decide whether to purchase his own combine harvester or not. He knows that if he wants to harvest his wheat in a hurry, then every other farmer in the district is likely to be in a similar position, and the hire of facilities from a pool could be difficult. . .

The fear of displacement or fall in status is something which has been grossly over-emphasized. Clerical personnel who are likely to be displaced by the introduction of an EDPM are, on the whole, female employees who have a very high rate of turnover anyway – 30 percent is not unusual. If a company ceases to employ people for a particular class of clerical work, adjustments of personnel numbers are quickly made . . .

. . . although the field of operations research is one which would not be a very profitable one were it not for computers, it is certainly not a panacea to all management ills. Even in terms of the help which can be rendered by automatic computing, it seems that present computers will not be fast enough to produce a "best" solution to many of the problems occuring in every-day business practice. However, in an increasingly large number of cases, they combine with mathematical techniques in doing better than human judgment. . .

MORE ON ICIP PLANS

four named to committee

Key professional engineering societies and computer activities will be represented in the management of the U. S. Delegation to the First International Conference on Information Processing sponsored by UNESCO in Europe next year. A four-man team has been named to comprise the United States Committee for the ICIP, it was announced by Isaac L. Auerbach, chairman of the group. One of the objectives of the committee will be to insure outstanding evidence of American technological competence in the course of this country's participation in the UNESCO event, scheduled in Paris or Rome in June, 1959.

The committee members will represent such engineering societies as the IRE, the ACM and the AIEE; will act as coordinators for the U. S. delegation's participation in the conferences, symposia and exhibits; and will function as consultants to UNESCO on certain aspects of the international conference.

Chairman Auerbach has already served as a consultant to UNESCO in helping to organize the conference on an international scale. Last December, he attended a Paris conference held by UNESCO's Department of Natural Sciences. It was attended by consultants from other nations, representatives of specialized United Nations agencies and representatives of international scientific unions.

Dr. Austin S. Householder will act as head of the program subcommittee. his group will be concerned with inviting specific papers from computer and data control experts within the United States. Other committee members are Dr. Samuel N. Alexander, chief of the National Bureau of Standards' data processing systems division and magazine editor Evan Herbert.

PAPERS SOUGHT FOR 1959 WJCC

Papers are being solicited for the 1959 Western Joint Computer Conference to be held at the Fairmont Hotel, San Francisco, on March 3-5, 1959. The theme of this conference will be "New Horizons With Computer Technology."

Conference planners state that, in selecting papers, they will place particular emphasis on those dealing with the newer applications of computer techniques, such as information retrieval, operation control, pattern analysis, decision making, computer communications, learning concepts, as well as on papers dealing with advances in computer component and systems design.

Tentatively, two sessions of a speculative nature are planned: A "blue sky session," and a session on "Philosophy and Responsibility of Computers in Society." Papers intended for the "blue sky session" should deal with the extension of computer technology into areas not considered feasible at present. They should indicate the advantages of such extension and the area of research necessary to bring this application into the feasible range. Papers for the second session mentioned should deal with philosophic and/or social implications of the widespread application of automatic computer techniques. These two sessions will be definitely scheduled only if a sufficient number of suitable papers are received.

A 20-minute delivery time is suggested for all papers. Their selection will be made from the complete text. There are no format requirements for these submission drafts. Three copies of the proposed paper should be submitted to the Technical Program Committee, 1959 Western Joint Computer Conference, Box 381, Station A, Palo Alto, Calif. by October 1 of this year.

After review, final selection of papers will be made and the authors will be notified by December 1, 1958. Submission of the final texts of the selected papers, in the form required by the Publications Committee, should be made by February 1, 1959.

new DATAMATION literature

MAGNETIC HEADS: A six-page technical paper with 16 graphs, drawings and illustrations on the subject of "Flux Responsive Magnetic Heads for Low Speed Read-out of Data" has been prepared by L. W. Feber. Following introductory paragraphs, the author deals with performance characteristics of a flux responsive head followed by a few applications, discussion and conclusions. The paper contends that a new approach has been found to utilizing magnetic data. The claim is made that information can be read out at low medium speed and, under certain conditions, at zero speed. Bulletin no. 9391 which covers high resolution magnetic heads is also available. For copy write CLEVITE ELECTRONIC COMPONENTS, a division of Clevite Corporation, 3311 Perkins Avenue, Cleveland 14, Ohio or use reader service card.

Circle 200 on Reader Service Card.

ENGINEERING CATALOG: Catalog G-300 covers this firm's complete line of miniature push button switches, rotary switches, binding posts, test clips and miscellaneous components. Fully illustrated, it includes engineering drawings of all items, giving standard dimensions. Complete specifications of all items are given covering electrical ratings, life load tests, materials used, applications and construction. Eleven new products, representing recent advances in miniaturization, are incorporated into the catalog. For copy write GRAYHILL, INC., 561 Hillgrove Ave., La Grange, Ill. or use reader service card.

Circle 201 on Reader Service Card.

TAPE EQUIPMENT: Explained in detail with accompanying specifications is the manufacturer's line of tape equipment. In the 10-page, two-color brochure will be found pictures, drawings and text covering equipment for tape preparation, tape reproduction, tape verification, input/output tabulation, super speed tape recording, paper tape reading, tape comparison and wide tape recording. For copy write SOROBAN ENGINEERING CO., Box 1717, Melbourne, Florida or use reader card.

Circle 202 on Reader Service Card.

ORTHOTRONIC CONTROL: A technical bulletin describing this firm's new method of automatic error-correction developed to insure uninterrupted accuracy in electronic data processing has been released. Included in the treatment of the new system are such subject headings as Organization of Information on Tape, Weight Count Checking, Orthochannel Generation, Corrective Procedure and Orthochannel Generation at Input Converter. (For details on the system, see four-page article beginning on page 30) For copy write DATAMATIC, a division of Minneapolis-Honeywell Regulator Co., 151 Needham St., Newton Highlands 61, Massachusetts or use reader service card.

Circle 203 on Reader Service Card.

ANALOG-DIGITAL CONVERTERS: Six models of this unit are detailed in an eight-page booklet. Included are code patterns for each which visually depict the actual arrangement of bits on each drum. A tabulation giving values for operating and other characteristics and relates to those components which are pictured and outlined is also included. A general description of the converters will be found on page one with operation and coding information. For copy write KEARFOTT CO., INC., Engineering and Sales Div., 1500 Main Ave., Clifton, N. J. or use reader service card.

Circle 204 on Reader Service Card.

DATA PROCESSOR: Contained in this literature package is a four-page folder describing and illustrating the operation and features of this unit, specifications, and a selection of applications data sheets compiled by the manufacturer. Applications described include inventory and stock control, payroll and time reporting, production control and applications in banking, stock brokerage, hospital operation, railroad and bus companies, savings and loan organizations and a list of other users. For copy write TALLER & COOPER, INC., Business Automation Equipment Div., 75 Front St., Brooklyn 1, N. Y. or use reader card.

Circle 205 on Reader Service Card.

TAPE RECORDER/REPRODUCER: This 16-page full color brochure offers a complete treatment of this firm's FR-100A modular magnetic tape recorder/reproducer for instrumentation. Stating that the unit may be used for data acquisition and storage, data analysis and reduction, machine and process programming and dynamic simulation, the brochure covers the FR-100A's features, accuracy, practicality, modifications and accessories. Each page is fully illustrated with pictures and drawings. An accompanying four-page specification sheet is also available. For copy write AMPEX CORPORATION, 934 Charter St., Redwood City, Calif. or use card.

Circle 206 on Reader Service Card.

DIGITAL INDICATOR: Catalog 51-1800 describes an in-line indicator which accepts a variable frequency a-c input – such as produced by turbine-type flow meters, tachometers, and other primaries – and converts it to a five-digit indication, accurate to within one frequency count. Five large, detailed drawings accompany the six-page paper. Included are background, features, description of operation, self-test procedure, standardization procedure, alarm lockout and trouble shooting procedure. For copy write FISCHER & PORTER CO., 627 Jacksonville Rd., Hatboro, Pennsylvania or use reader service card.

Circle 207 on Reader Service Card.

DATA SYSTEM, CONVERTERS: Specification sheets are available for this manufacturer's TE-206 data system, 768G-1 Kinecard converter and 768H-1 Kinetape converter. All three sheets contain descriptions of the units, pictures and detailed specifications. Information concerning equipment with which the units can be used is also included. For copies write COLLINS RADIO CO., Western Division, 2700 W. Olive Blvd., Burbank, Calif. or use reader service card.

Circle 208 on Reader Service Card.

MEASUREMENT SYSTEM: A four-page folder which includes pictures and drawings deals with this manufacturer's line of precision measurement instruments. After a brief description of the measuring system, details are presented on accuracy, optical unit and counter unit including digit sizes and measuring speed. For copy write FERRANTI ELECTRIC, INC., Electronics Div., 95 Madison Ave., Hempstead, Long Island, New York or use reader service card.

Circle 209 on Reader Service Card.

SEMICONDUCTOR PRODUCTS: A new folder covers all the electrical and physical characteristics of this company's semiconductor products. It was designed specifically for electrical and electronic design engineers and fits into a regulation three-ring binder. Its design permits convenient reference to products and the product lines have been broken down into 14 categories. For copy write HOFFMAN ELECTRONICS CORP., Semiconductor Div., 920 Pitner Ave., Evanston, Ill. or use reader service card.

Circle 210 on Reader Service Card.

ANALOG COMPUTER: Now available is a fully illustrated eight-page brochure describing model MC-400 desk-side analog computer. A large illustration shows the free-rolling castered cabinet and clearly indicates the 16 scale-factor potentiometers, precision servo multiplier, true-overload alarm, monitor and control panel, vacuum-tube voltmeter, complete programming patchcord, and other features which are standard equipment. The brochure gives a detailed description of the operational amplifiers and the other standard and optional equipment, including removable patchboards. Fully illustrated applications are included. For copy write MIDCENTURY INSTRUMATIC CORP., 611 Broadway, New York 12, New York or use reader service card.

Circle 211 on Reader Service Card.

DIGITAL RECORDER REPRODUCER: Bulletin 1608 is a two-page bulletin which stresses these features of type 5-680 digital magnetic-tape recorder/reproducer: all transistorized electronics, stops and starts in less than three milliseconds, all-metal-surface magnetic heads, tape widths form ½ in. to one in. and continuous-duty servo motors. Complete specifications, a photograph and sales and service office addresses are included. For copy write CONSOLIDATED ELECTRODYNAMICS CORPORATION, 300 N. Sierra Madre Villa, Pasadena, California or use reader service card.

Circle 212 on Reader Service Card.

PLASTIC LAMINATES: Copper-clad plastic laminates for electronic printed circuits are the subject of a new technical bulletin. Describing the laminates as a combination of high-purity (99.5% or better) rolled copper on plastic base materials, the four-page illustrated bulletin includes tables listing physical, mechanical and electrical characteristics of the four grades now in standard production: grades XP, Cu-246, XXXP-242 and GEC-500. Typical circuits made up from the copper-clad laminates are shown

in photos. Sheet sizes, thicknesses of copper cladding and other information are given. For copy write TAYLOR FIBRE CO., Norristown, Pennsylvania or use reader service card.

Circle 213 on Reader Service Card.

DECADE INDUCTORS: Bulletin LP 121.1 describes these high Q, low frequency units available in three decades with maximum values of .1h, 1.0h and 10h, which may be combined to permit switching in any value of inductance from 0.1 to 11.1 henries in .01h steps. A brief account of the units giving applications is followed by a full page of specifications and illustrative drawings. For copy write COMPUTER ENGINEERING ASSOCIATES, INC., 350 N. Halstead, Pasadena, Calif. or use card.

Circle 214 on Reader Service Card.

ANNUNCIATOR: This four-page, two-color brochure contains information of a new static-magnetic annunciator developed for monitoring complex automatic machine and continuous process operations. The unit uses static-magnetic controls instead of conventional relays. No moving parts result in high reliability and reduced maintenance, claims the manufacturer. Text is accompanied by line drawings and a photograph. For copy write PANELLIT, INC., 7401 N. Hamlin Ave., Skokie, Ill. or use reader card.

Circle 215 on Reader Service Card.

COMPUTER APPLICATION: Folder U1436, "60-Second Management Interview," tells how a railroad – the Spokane, Portland and Seattle – gets complete stores control using the Univac 60. For copy write REMINGTON RAND UNIVAC, Division of Sperry Rand Corp., 315 Fourth Ave., N. Y. 10, N. Y. or use reader service card.

Circle 216 on Reader Service Card.

CONNECTORS: A completely revised 40-page, four-color catalog on series 20 miniature connectors has been released. Complete specifications, outline drawings, illustrations and general information make this comprehensive catalog a source of miniature connector data for engineering and purchasing files, company libraries and technical personnel who buy or specify electronic connectors. Covered are such items as guide pins and sockets, aluminul hoods, polarizing screwlocks, panel cutouts and others. For copy write DEJUR-AMSCO

NEW LITERATURE

CORP., Electronic Sales Div., 45-01 Northern Blvd., Long Island City 1, N. Y. or use reader service card.

Circle 217 on Reader Service Card.

DATA TRANSLATOR: A four-page literature item describing the unit which translates data from one medium to another in off-line operation and from the language of one system to the language of another for compatibility between data handling systems, has been released. The piece offers typical translations, applications and a diagram of the system's building blocks with accompanying explanatory text. For copy write TELEMETER MAGNETICS INC., 2245 Pontius Ave., Los Angeles 64, California or use reader service card.

Circle 218 on Reader Service Card.

ANALOG COMPUTER: Catalog sheet C-20 presents details and specifications of the Esiac computer, model 10. After covering the subjects of "What it Does" and "What it Is," the booklet presents an example of how the computer plots an answer to a specific problem. A section on the model 10 theory of operation complete with equations and a line drawing illustration concludes the offering. For copy write ELECTRO-MEASUREMENTS, INC., 7524 S. W. MacAdam, Portland 1, Ore. or use card.

Circle 219 on Reader Service Card.

TRANSISTORIZED CONVERTER: A single-page technical bulletin describes a transistorized analog-to-digital converter model 50DC1000. Details included: inputs, outputs, display, operation, characterization and chassis specs. For copy write FISCHER & PORTER CO., 790 Jacksonville Rd., Hatboro, Penna. or use reader card.

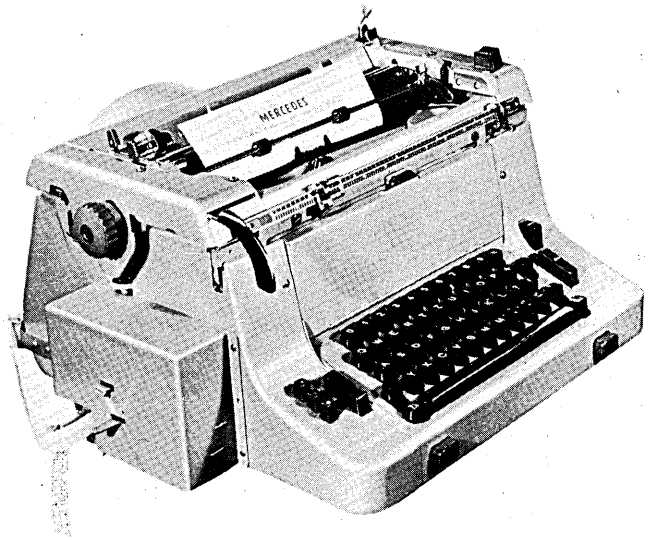
Circle 220 on Reader Service Card.

ENGLISH FIRM MARKETS TAPE PUNCH TYPEWRITER

Mercedes Sterline of 11 Ludgate Circus, London E. C. 4 has announced the availability of the new Mercedes electric typewriter with automatic tape punch attachment. This machine is manufactured by "Buromaschinenwerke, A. G. Zellawehlis"—in Thuringen, Germany.

Mercedes' typewriter-tape punch can be supplied with either five or eight channel tape, and any desired combination of letters, figures and symbols. The five channel tape has 31 combinations, and the eight channel, 255. When using five channel, "Zi" key is depressed before typing figures and symbols (all letter keys are then locked) and "Bu" key before typing letters (symbol keys are locked).

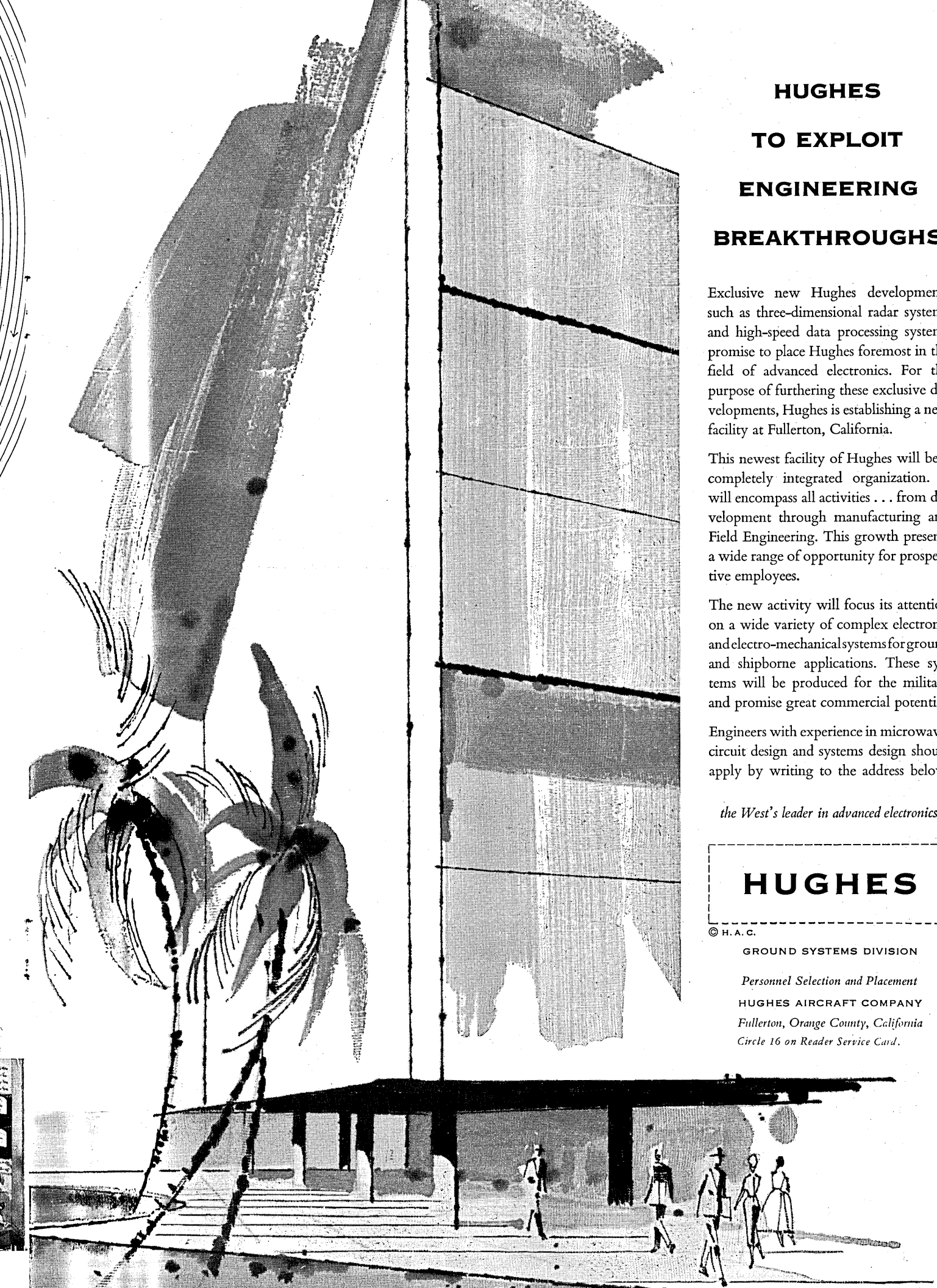
The tape punch can be disconnected and the machine used as a straight electric typewriter. All information typed is transmitted to the tape (when connected). Tape can be supplied in lengths of 150 or 400 metres. A 400 metre coil can accommodate 120,000 characters. A red light gives warning when the end of the tape is approaching. (Decimal



tabulation and automatic zeroing cannot be supplied on the typewriter at this time.)

All models of an accounting machine, manufactured by the same firm, which has punch paper tape output can also be supplied with five or eight channel tape. Decimal tabulation and automatic zeroing is provided on these units. A control bar automatically selects items for transmission to the tape and ignores items not required. Control bars can be fitted for varying programs. A green warning light indicates that items are being transmitted to the tape and a red one again warns of the end of the tape approaching. The punch device has a positive mechanical action from an electrically driven rotating shaft. Therefore the possibilities of inaccuracy through fluctuating voltages or solenoid troubles cannot arise, the company states.

Circle 104 on Reader Service Card.



HUGHES TO EXPLOIT ENGINEERING BREAKTHROUGHS

Exclusive new Hughes developments such as three-dimensional radar systems and high-speed data processing systems promise to place Hughes foremost in the field of advanced electronics. For the purpose of furthering these exclusive developments, Hughes is establishing a new facility at Fullerton, California.

This newest facility of Hughes will be a completely integrated organization. It will encompass all activities . . . from development through manufacturing and Field Engineering. This growth presents a wide range of opportunity for prospective employees.

The new activity will focus its attention on a wide variety of complex electronic and electro-mechanical systems for ground and shipborne applications. These systems will be produced for the military and promise great commercial potential.

Engineers with experience in microwave, circuit design and systems design should apply by writing to the address below.

the West's leader in advanced electronics

HUGHES

GROUND SYSTEMS DIVISION

Personnel Selection and Placement

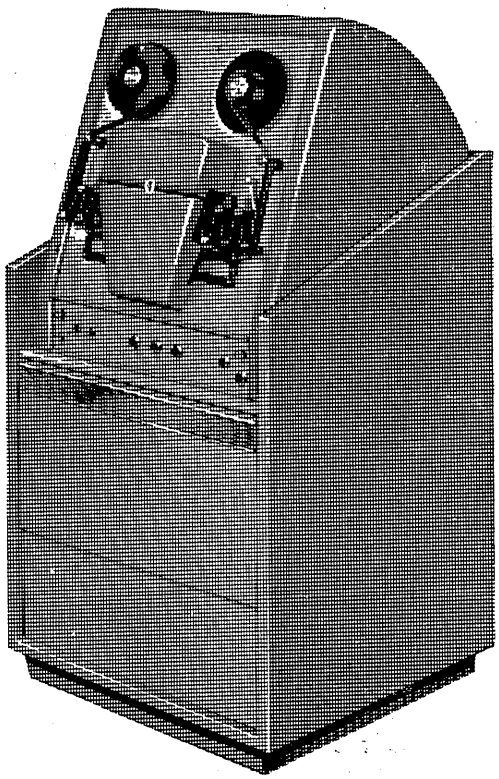
HUGHES AIRCRAFT COMPANY

Fullerton, Orange County, California

Circle 16 on Reader Service Card.

Burroughs Photoreader

reads this many characters in one second!



1,000 CHARACTERS PER SECOND! And it stops on a single character... then reads the next character within five milliseconds after restart! The new Burroughs Photoreader by ElectroData Division of Burroughs Corporation is now commercially available... the finest precision paper tape reader of such high-speed performance being offered as a component. Speed of the Photoreader introduces a new high in computer-time efficiency to business and scientific data processing. Its instantaneous stop-ability simplifies computer techniques... also brings faster, more efficient operation to missile test checkout, fire control systems, equipment test procedures and machine automation. The Photoreader is adaptable to standard-width tape, from five to eight level code. Economic plastic reels are available in two sizes for tapes of 350 or 700 feet (40,000 or 80,000 Characters). Automatic rewind and end-of-tape sensing; true straight-line loading and drift-free design. Developed as an input unit for the new Burroughs 220 data processing system, the Photoreader is also available as a component for mounting in any standard 19″ cabinetry. It may also be ordered already housed in the Burroughs 220 cabinet, as pictured. For complete details write

Burroughs Corporation
ELECTRODATA DIVISION
PASADENA, CALIFORNIA

stops on a single character!

On display ISA Show – September 15-19 – Booth #1045

Circle 17 on Reader Service Card